

FRIDAY, MAY 11, 1883.

A STRANGE PERFORMANCE.

WHOM the gods would destroy, they first make mad. Mr. Hubert Howe Bancroft, having shown great capacity as an organizer of an encyclopaedia company, and having assumed not only to be an historian, but to dispense opinions oracularly, and to patronize and discredit distinguished writers, now throws the ethics of trade aside, and exalts himself to a place among self-praising martyrs. He gravely announces that purchasers of his earlier volumes must now subscribe to them over again in order to get the rest of the series, and sends out an extraordinary lithographed form of subscribing, in one corner of which is a list of the thirty-nine volumes, with the prices.

“ ————— 188 .

“ TO HUBERT HOWE BANCROFT, San Francisco, Cal.

“ *Dear sir,* — In token of my high appreciation of the value to the Pacific coast and to the world, of your long and arduous historical labors in a new field, and after a manner peculiar to yourself, I hereby tender my subscription to a complete set of your literary works in thirty-nine volumes, payments to be made at the regular published price as the volumes are issued and delivered.

—
“ After your signature, please designate style of binding.”

We doubt if a more flagrant piece of folly was ever perpetrated by a book-maker.

It is melancholy and significant, that while the few historical students, as tested in different centres, who are competent to pronounce on the value of Mr. Bancroft's History, are agreed in a qualified, and in some respects a condemnatory, estimate of its methods and performance, the general reviewers of the book have been simply dazed by its magnitude.

Any departure from laudation strikes Mr. Bancroft as inquisitorial, and unkind to a man who never made any pretensions to being an historian. Such a spirit is commendable and disarming; but when he becomes mad and militant, he arms his critics. Two protests against this universal flattery have struck him deeply.

These offenders are the *New-York independent*, which took up his claim of making a contribution in his notes to the bibliography of the subject, and which showed how preposterous such claim was; and the *New-York post* and *Nation*, which took him to task for his opinions on the early Mexican civilization, and for his churlish discourtesy to the late Lewis H. Morgan, — a man of pre-eminent reputation, whom Mr. Bancroft modestly accused of seeking to obtain a little cheap notoriety by attacking his (Mr. Bancroft's) views. Mr. Bancroft has made answer to these reviews in a tract, of which he requests an opinion, which we give him. He does not print or quote in any comprehensible way the articles which annoy him; and so the reader is left, unless otherwise informed, to infer the nature of these questioners' criticism from his own discourteous and specious language, which takes on a humorous sort of mongrel admiration in the juncture of such words as 'astute hair-splitter' and 'erudite dogmatist.' Without citing proofs, he accuses them of ignorance and mud-throwing, and thus makes but the vaguest responses to clear exemplifications of his own ignorance, to citations of the inadequacy of his index-mongery, and to instances of perversions, which the reviewers adduced. The reviews in question were severe, and, from the nature of the case, cutting; but they were not disfigured by foul language, and were explicit. His answer is vituperative and general. This pamphlet is eked out with extracts of laudatory comment growing out of the average conception of 'a big thing' from all sorts of sources, including a fresh commendation from certain California judges, who have no status, certainly, as students in this field, however reputable their legal qualifications and general intelligence. Some of Mr. Bancroft's gyrations are not more strange than the opinions which seem to have been wrung by him from various eminent people concerning this 'Macaulay of the west.' More than one distinguished gentleman has discovered to his annoyance, that polite sentences, in notes of acknowledgment for presentation

copies, have been used to swell this chorus of admiration.

He has another craze. He chooses to assert that there is a conspiracy among what he calls 'the Morgan men' to depreciate and crush him, and that these two articles are part of the plan. We suspect archeology is too engrossing a study for such trivial by-play; and we know, also, that the editors, whom he berates for lending themselves to such a plot, found students in the field too inclined to ignore his work, to bring themselves easily to the bestowal of any time upon criticising it. It is piteous to think how what might have been a useful labor is resulting in discredit and personal intrusiveness.

A STUDY OF THE HUMAN TEMPORAL BONE.—I.

It may be asked why the writer of the present article should publish a subject which has already been so thoroughly and repeatedly investigated, is so familiar, and is treated with the utmost detail in many manuals of anatomy. In his experience as a teacher of anatomy, he has, of necessity, been obliged to observe many important points over and over again; and, as one of the results, he has been led to see some of them differently from the views commonly entertained. As no other bone is so complex as the temporal, and none more important in its relations, it occurred to him that his view of it might prove of interest to students. No discoveries are claimed, and it is probable that what is here written may be found in previous anatomical literature. In some points the details are less complete than those given in the admirable, accurate, and exhaustive 'Handbuch der anatomie' of Professor Henle; but others are perhaps more definitely indicated. For brevity, some of the more obvious details, given in every manual, are excluded.

For convenience of study and reference, it is usual to consider the temporal bone as consisting of the squamous, mastoid, and petrous portions, though these do not accord with the natural divisions observed in its development. To avoid circumlocution, the terms 'squamosa,' 'mastoidea,' and 'petrosa,' are substituted for the ordinary phrases 'squamous portion,' etc.

The *squamosa* is the irregularly circular or oval plate, upright in position, at the fore-part of the bone. Its outer surface, nearly flat or

feebly convex, forms part of the temporal fossa. The inner surface is concave and pitted, as usual in the other bones of the cranium, and is marked by grooves for the great meningeal vessels. It is commonly defined by a fissure of variable extent, remaining as part of the petro-squamosal suture.

Projecting from the lower part of the squamosa, externally, is the *zygomatic process*, which articulates with the malar bone to form the zygoma. The base of the process is broad and strong, and has its upper surface slanting forward. The upper sharp border of the process is continuous backward with a curved line, the *temporal ridge*, which defines the squamosa from the mastoidea.

The squamosa underneath forms the articular surface for the mandible, consisting of the glenoid fossa with the articular eminence in front; both extending outwardly below the root of the zygomatic process. The *glenoid fossa* is a deep, transversely oval concavity, defined behind by the glenoid fissure. The *articular eminence* is a transverse ridge of variable thickness, convex fore and aft, and more or less concave to straight transversely. Variable prominences at the outer part of the articular surface are the *anterior* and *posterior glenoid processes*.

The *mastoidea* is the outer back part of the bone, externally defined from the squamosa by the temporal ridge. It is prolonged below into the conspicuous nipple-shaped eminence, the *mastoid process*. Internally, to the base of the process, is a large fore-and-aft groove, the *digastric fossa*; and internally to this again is a narrow groove for the occipital artery.

The broad archway between the mastoid and post-glenoid processes is formed by the *auditory plate*¹ (fig. 2, *d*), which extends inwardly as the roof of the external auditory meatus. It is partially defined from the temporal ridge by a variable, irregular crescentoid indentation.² The inner extremity defines the meatus from the tympanic cavity by an acute curved edge, from which a wide crescentoid plate, the *tympanic scute*,³ slants upward, and forms the outer boundary of the upper portion of the tympanic cavity. The *scute* (fig. 1, *b*; fig. 2, *c*) can best be seen by sawing the temporal bone fore and aft through the tympanic cavity, and viewing the outer division of the bone from within. The scute is separated externally from the rest of the auditory plate by spongy substance, but occasionally is continuous through thick, compact substance. Its anterior border joins the

¹ Lamina auditoria.

² Post-auditory fossa.

³ Scutum tympanicum.

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and its posterior surface is continuous with the fore-part, giving substance of the outer wall of the mastoid antrum.

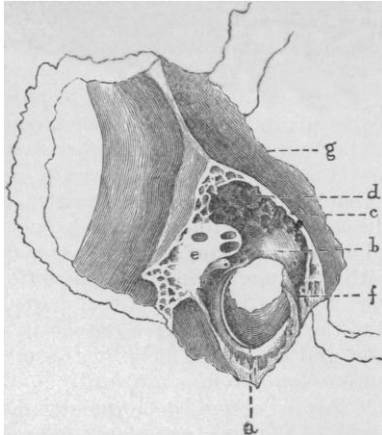


FIG. 1.—View from within of the outer portion of the left temporal bone, sawed through the tympanum, fore and aft, parallel with its inclination. *a*, tympanic margin of the external auditory meatus, formed below and at the sides by the grooved margin of the tympanic plate, and above by the margin of the auditory plate; *b*, scute, forming the outer boundary of the attic; *c*, tegmen; *d*, mastoid antrum; *e*, prominence of the inner posterior boundary of the attic; *f*, canal for the accommodation of the long process of the malleus; *g*, petro-squamosal fissure. Below *e* are seen the pyramid, and the aperture of the tympanic cord.

The inner surface of the mastoid forms part of the posterior cranial fossa. Contiguous to the petrosa, it is impressed by the large curved channel for the lateral sinus. The upper border is defined from the squamosa by a notch, which receives the posterior inferior angle of the parietal bone. Usually a short canal¹ pierces the posterior border, from the outer surface to the groove for the lateral sinus, for the transmission of a vein.

The *petrosa* is a prostrate three-sided pyramid, with its base applied outwardly against the squamosa and mastoid, and with its apex directed obliquely forward in the base of the cranium, between the occipital and sphenoid bones.

The posterior surface of the petrosa is the smallest, and forms an uneven slope at the fore-part of the posterior cranial fossa, defined outwardly by the groove for the lateral sinus. Internally, to its middle, is the *internal auditory meatus*, a short, wide canal for the passage of the auditory and facial nerves. Outward from the meatus is an oblique cleft of variable extent, sometimes large and conspicuous, and sometimes nearly obsolete. It communicates with a fine canal,² extending to the vestibule, for the passage of a vein.

¹ Mastoid foramen.

² Aqueduct of the vestibule.

er of the petrosa is an acute ridge, which continues outwardly to the upper border of the mastoid, and gives attachment to the tentorium. It is usually marked along its course by a groove for the superior petrosal sinus, and its inner extremity is impressed by the trifacial nerve.

The posterior border of the petrosa is sharp and irregular, and joins the occipital bone. Its middle skirts the fore-part of the jugular foramen, and commonly exhibits two notches, separated by an angular process, which gives attachment to a partition of the dura dividing the foramen. At the apex it is usually marked by a groove for the inferior petrosal sinus.

The anterior border of the petrosa is the shortest; and it forms, with the squamosa, a notch, which receives the angular process of the sphenoid bone.

The anterior surface of the petrosa, broad and uneven, forms the posterior boundary of the middle cranial fossa. Above its centre, a conspicuous prominence, together with the contiguous depression internally, marks the position within of the labyrinth. Another depression in front of the apex accommodates the ganglion of the trifacial nerve, and the notch just below communicates with the carotid canal. The portion of surface below the position occupied by the labyrinth is formed by a wide, triangular plate, the *tegmen*,¹ which covers the tympanum, the mastoid antrum, and the eustachian tube. It is commonly more or less defined by a fissure, remaining as part of the petro-squamosal suture, which at birth extends from the notch at the bottom of the squamosa to that at its upper border. Frequently, also, a vascular groove, and several foramina for the transmission of vessels, mark the line of separation. The inner extremity of the tegmen is further somewhat defined from the rest of the petrosa by a groove directed outwardly, and ending in a small aperture, the *hiatus*² of the facial canal, for the entrance of the great superficial petrosal nerve. From the extremity of the tegmen, a narrow bar dips into the glenoid fissure, and separates the tympanic plate from the squamosa. The under part of the tegmen is commonly formed by a layer of spongy substance of variable thickness.

The inferior surface of the petrosa is very uneven. At its fore-part, outwardly, is situated the *tympanic plate*, originally a distinct bone from the rest of the petrosa. It presents a broad, concave surface, directed towards the glenoid fossa, and defined from this by the gle-

¹ T. tympani.

H. Fallopii.

noid fissure. It is produced below into a sharp, irregular crest, the *vaginal process*, variably extended into several uneven points.

The outer portion of the tympanic plate is produced into a cylindrical scroll, which forms the floor and sides of the external auditory meatus. The rough, crescentic border at the entrance of the latter is the *auditory process*, and gives attachment to the auricle. The scroll terminates at the inner extremity of the meatus with an abrupt *tympanic margin* (fig. 1, *a*), which is grooved along its course within for the insertion of the tympanic membrane.

The inner extremity of the tympanic plate closes the lower part of the eustachian tube.

Back of the vaginal process, and partially sheathed by a downward extension of the same, is the usually conspicuous *styloid process*. This is a narrow, tapering spine, of variable length, from half an inch to an inch or more, directed from the petrosa downward, forward, and inward. Before maturity it is commonly a distinct bone,¹ joined by cartilage to a short cylindrical base,² which occupies a pit or groove embraced by the vaginal process. Prior to puberty it is, for the most part, cartilaginous, and is usually lost in prepared specimens of the temporal bone.

Between the styloid and mastoid processes is the *stylo-mastoid foramen*, which is the exit of the facial canal. Behind it is a broad, mostly quadrate, articular facet, which joins the jugular process of the occipital bone. Adjacent, inwardly, is the *jugular fossa*, a concave recess of variable capacity, and commonly differing proportionately from that of the opposite bone of the same skull. It accommodates the commencement of the jugular vein, and forms the fore-part of the outer division of the jugular foramen. To its inner side is a pyramidal pit, which communicates at bottom with a fine canal,³ extending to the cochlea, for the passage of a vein. The mouth of the pit extends downward in a groove, which forms the fore-part of the inner division of the jugular foramen.

Inwardly from the lower extremity of the jugular fossa, and behind the inner extremity of the vaginal process, is the entrance of the *carotid canal*. This ascends vertically, and then curves abruptly inward, and proceeds to the apex of the petrosa. It is sometimes incomplete at its inner fore-part, when, in the recent state, it is closed by fibrous membrane. It gives passage to the internal carotid artery and sympathetic nerve.

The uneven surface beneath the apex of the petrosa, at the fore-part, gives origin to the elevator of the palate, and, just behind, gives attachment to the pharynx. Back of this, the irregularly grooved part joins the occipital bone, having the interval occupied by fibro-cartilage.

The *external auditory meatus*, or outer passage of the ear, in the prepared bone, communicates at bottom with the tympanic cavity. It is a curved canal, with the convexity upward, and is about two-thirds of an inch in length. It is directed from without inward, and a little forward and downward. Its cross-section is oval, with the longer diameter inclined forward. The roof, formed by the auditory plate, is extended to the greatest degree outwardly; while the floor and sides, formed by the tympanic plate, are extended most inwardly. The entrance is formed above by the narrowing of the broad arch of the auditory plate, and below by the auditory process curving up at the sides to the roof of the meatus. The *tympanic orifice*¹ (fig. 1, *a*), or communication with the tympanic cavity, is oval, or nearly circular, and very oblique, with its plane inclined outward and downward to an angle of about 50°. It is formed above by the sharp, curved tympanic margin of the auditory plate, and below by the horseshoe-like tympanic margin of the tympanic plate, grooved within for the insertion of the tympanic membrane.

The *glenoid fissure*² defines the tympanic plate from the fore-part of the squamosa, behind the glenoid fossa, and remains as a portion of the petro-squamosal suture. Its outer part is closed by ankylosis of the tympanic plate with the post-glenoid process. Its inner part receives a bar, dipping into it from the tegmen of the petrosa, and separating the tympanic plate from the squamosa. At its middle is a foramen, — the exit of a short, oblique canal³ from the tympanum, for the accommodation of the long process of the mallet and the tympanic cord.

The *eustachian tube* is a short, oblique canal, communicating outwardly with the tympanum, and opening inwardly in front of the apex of the petrosa, at the notch between this and the squamosa. It is formed in front and beneath by the inner extremity of the tympanic plate, above by the tegmen, and behind by the anterior wall of the carotid canal. Its inner extremity is roughened for the attachment of the cartilaginous portion of the tube.

¹ Stylo-hyal.

² Tympano-hyal.

³ Aqueduct of the cochlea.

¹ Apertura tympanica.

² Fissure of Glaser; Glaserian fissure.

³ Canal of Huguier.

At the upper part of the tube, extending into the tympanum, is the receptacle of the tympanic tensor muscle. This is formed by a thin, cylindrical scroll, commonly open along its fore-part, but closed in the recent condition by fibrous membrane. The upper extremity of the scroll tapers, curves outwardly, and projects as a short conical process¹ into the tympanum. Sometimes the receptacle forms a complete osseous tube, open only at the ends.

The *internal auditory meatus* is a cylindrical canal, about a third of an inch long, extending directly outward from near the middle of the posterior surface of the petrosa. The bottom of the meatus is directed forward and outward, and is applied to the base of the cochlea and to the vestibule. It is divided into two fossae by a transverse ridge, which expands, at the extremities, into the front and back walls of the meatus. In the upper fossa, internally, is the aperture of the *facial canal*,² by which the facial nerve leaves the meatus. The facial canal advances a short distance, and communicates, through the *hiatus*,³ with the anterior surface of the petrosa. Turning abruptly outward and backward in the upper part of the inner wall of the tympanum, it then curves downward in the posterior wall, and ends under the name of the stylo-mastoid foramen. It is sometimes open along its course at the upper part of the tympanum, but is then closed in the recent state by fibrous membrane. Outward from the entrance of the facial canal is a concave recess, with a circular or oval group of minute foramina, which communicate with the *superior cribriform macula* of the vestibule. On the outer extremity of the transverse ridge of the bottom of the meatus there is a variable number of little pits, or foramina, usually two or three, which likewise communicate with the macula just mentioned.

The lower fossa of the meatus is impressed with a band-like *spiral tract*,⁴ which is pierced along its course with numerous minute foramina. These sometimes exhibit a slight tendency to arrangement in little groups in longitudinal series; though I have never seen a specimen exhibiting even a well-marked approximation to the regularity represented in fig. 725 of Sappey's *Traité d'anatomie*, second edition. The foramina communicate with canals of the modiolus, and transmit the filaments of the cochlear nerve.

Centrally, at the termination of the spiral tract, there is usually a conspicuously larger

foramen, which gives passage to the central artery of the modiolus.

Above the commencement of the spiral tract, and just below the transverse ridge, is a recess, variably distinct, sometimes scarcely marked from the spiral tract, sometimes forming a conspicuous depression or pit, with a little circular group of minute foramina, which communicate with the *middle cribriform macula* of the vestibule.

In the outer wall of the meatus, near the recess just indicated, is the aperture of a narrow canal, which is directed outwardly, and terminates in a group of minute foramina, which communicate with the *inferior cribriform macula* of the ampulla of the posterior semicircular canal. The three groups of foramina, communicating with the cribriform maculae, transmit the filaments of the three divisions of the vestibular nerve.

The *tympanic cavity* occupies a position at the fore-part of the petrosa, beneath the tegmen, and closed in front by the tympanic plate. It communicates outward with the external auditory meatus, outward and backward with the mastoid antrum, and inward and forward with the eustachian tube. Closed externally by the tympanic membrane, it forms the *tympanum*, or ear-drum, — an air-chamber intermediate to the external auditory meatus and the labyrinth. Within it are contained the ear-ossicles.

The tympanic cavity is obliquely placed parallel with the long axis of the petrosa. It may be regarded as consisting of two portions, — the main chamber, which may be named the *atrium*, situated directly opposite the external auditory meatus; and a recess above this, which may be distinguished as the *attic* (fig. 1, b).

The *atrium*¹ is discoid in shape, and is defined outwardly by the prominent edge of the tympanic orifice of the external auditory meatus. Its usual dimensions are about half an inch obliquely, fore and aft, and in height, and about two and a half lines from within outward. The inner wall is next the labyrinth, and in great part is visible through the external auditory meatus. It exhibits a conspicuous smooth eminence, the *promontory*, caused by the projection of the cochlea. The back part of this arches over a deep recess, looking backward and outward, and having at its inner side an aperture, the *round window*,² which communicates with the cochlea, and, in the recent state, is closed by the cochleo-tympanic

¹ Processus cochleariformis. ² Aqueduct of Fallopius.

³ H. Fallopii.

⁴ Tractus spiralis foraminosus.

¹ Atrium tympanicum.

² Fenestra rotunda; f. cochleae.

membrane.¹ Above the promontory, and over the position of the round window, is a concave recess, at the bottom of which is the *oval window*.² This is half oval or slightly reniform, with its longer diameter nearly horizontal, and it is directed outwardly. It communicates with the vestibule, and, when complete, is closed by the insertion of the base of the stirrup.

In advance of the oval window is the projecting end of the scroll or tube, which serves as a receptacle for the tympanic tensor muscle.

Below the promontory, curving fore and aft around it, is a concave, rough, cellular recess, which extends outwardly, and is defined by the tympanic margin of the tympanic plate. The lower part of the recess is the floor of the tympanum, situated above the jugular fossa; its back part forms the lower portion of the posterior wall of the tympanum; and its fore part, the lower portion of the anterior wall, situated just external to the ascending portion of the carotid canal. Above the recess, in front and inwardly, is the orifice of the eustachian tube. In front of this is the short, narrow, oblique canal, which opens into the glenoid fissure, and receives the long process of the mallet, together with the tympanic cord.

Within the posterior wall of the tympanum is the descending portion of the facial canal; and in advance of this is the receptacle for the stapedius muscle. The receptacle is a cylindrical cavity, about a fourth of an inch long. Ascending in front of the facial canal, it then curves forward beneath this, and tapers to an aperture at the summit of a little conical process, the *pyramid*. It is separated from the facial canal by a thin partition; but this is not unfrequently more or less imperfect, and is then, in the recent state, closed by fibrous membrane. The receptacle also communicates with the facial canal by one or two small canals for the passage of the vessels and nerve of the stapedius. The pyramid projects forward into the tympanic atrium, behind the position of the oval window. It is commonly connected with the contiguous wall by several little radiating bars, one of which joins the promontory. Between the pyramid and the recesses of the round and oval windows there are two vacant recesses.

Close to the back margin of the tympanic orifice of the external auditory meatus, a little below the level of the pyramid, is the opening of a small canal from the facial canal, which admits the tympanic cord into the tympanum.

The *attic*¹ of the tympanum is a pyramidal recess over the atrium, and above the tympanic orifice of the external auditory meatus. Its upper anterior boundary is the tegmen, which separates it from the cranial cavity, and is mostly provided with a layer of spongy substance of variable thickness. Its inner boundary is a convex prominence (fig. 1, *e*; fig. 2, *b*) produced by the contiguous portions of the external semicircular and facial canals. Its outer boundary is the wide crescentic tympanic scute (fig. 1, *b*; fig. 2, *c*) of the auditory plate. It opens above the prominence of its inner boundary, outward and backward, by a large aperture² into the mastoid antrum. Beneath, it opens into the atrium by an elliptical aperture, formed internally by the ridge of the facial canal, and externally by the tympanic margin of the auditory plate. The attic is partially occupied by the mallet and anvil, which thence, by the handle of the former, and the long process of the latter, extend into the atrium.

The *mastoid antrum* (fig. 1, *d*; fig. 2, *f*) is a prolongation of the attic backward and

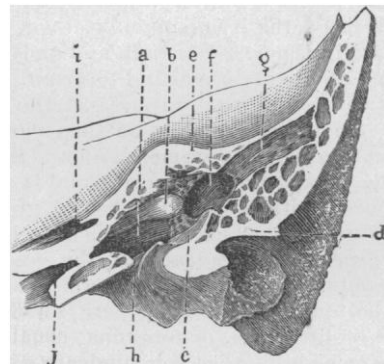


Fig. 2. — Section of the left temporal bone, through the squamosa, immediately in advance of the external auditory meatus. *a*, atrium of the tympanum; *b*, prominence on the inner back part of the attic; *c*, scute at the outer part of the attic; *d*, auditory plate; *e*, tegmen; *f*, mastoid antrum; *g*, anterior passage of the same; *h*, canal for the long process of the mallet; *i*, hiatus of the facial canal; *j*, eustachian tube.

outward in the spongy substance of the mastoid. It is of variable size, ordinarily ranging from that of the attic to double the dimensions of this. It sometimes ends in a blunt, flask-like recess, but is oftener more or less extended downward among the cellules of the mastoid process. Frequently it gives off a smaller fork or passage (fig. 2, *g*), which is directed outward and upward among the

¹ Secondary membrane of the tympanum.

² Fenestra ovalls; *f*. vestibuli.

¹ Atticus tympanicus, upper chamber of the tympanum of Huxley.

² Petro-mastoid canal of Sappey.

cellules above the external auditory meatus; and rarely a third branch is directed more anteriorly.

While the atrium of the tympanum varies but little in size, the attic and mastoid antrum vary greatly.

The *mastoid cellules*¹ consist of air-cavities of variable number, size, and extent, in the midst of the spongy substance of the mastoid. They are commonly more or less proportioned in number and size with age. With the advance of years, they increase in both respects from the conversion of the ordinary marrow-filled, spongy substance into vacant spaces. Later they increase in capacity by expansion and coalescence, and proportionately decrease in number; and often in old age some of them even exceed in size the antrum. The cellules communicate with one another, and, through the sides and extremity, with the mastoid antrum.

Some small but important foramina and canals of the temporal bone, besides those mentioned, are worthy of notice.

In the ridge separating the jugular fossa from the entrance of the carotid canal, there is a fine canal which ascends to the tympanum. It communicates with the atrium at the inner part of the floor, beneath the promontory, and is thence continuous with a groove ascending and dividing into several branches upon the latter. The canal gives passage to the tympanic nerve, which is distributed upon the promontory.

Among the nutritious foramina of the carotid canal, chiefly on its outer wall, there are several larger ones, which communicate with the tympanum, and transmit one or two minute arteries and connecting branches of the tympanic nerve with the sympathetic nerve.

Likewise, in the jugular fossa, there are several foramina communicating with the tympanum for the passage of minute veins. Another foramen in the fossa extends in a fine canal outwardly, and opens into the fissure between the mastoid and auditory processes. The canal transmits the auricular branch of the vagus nerve, and, in its course, communicates with the facial canal.

On the inner extremity of the tegmen, a cleft or groove ends in a fine canal, which proceeds outwardly to the inner side of the receptacle of the tympanic tensor, and communicates with the tympanum. The canal transmits the small superficial petrosal nerve. Another small groove on the tegmen, close to that for the large superficial petrosal nerve,

likewise ends in a fine canal, communicating with the facial canal, for the transmission of the least superficial petrosal nerve.

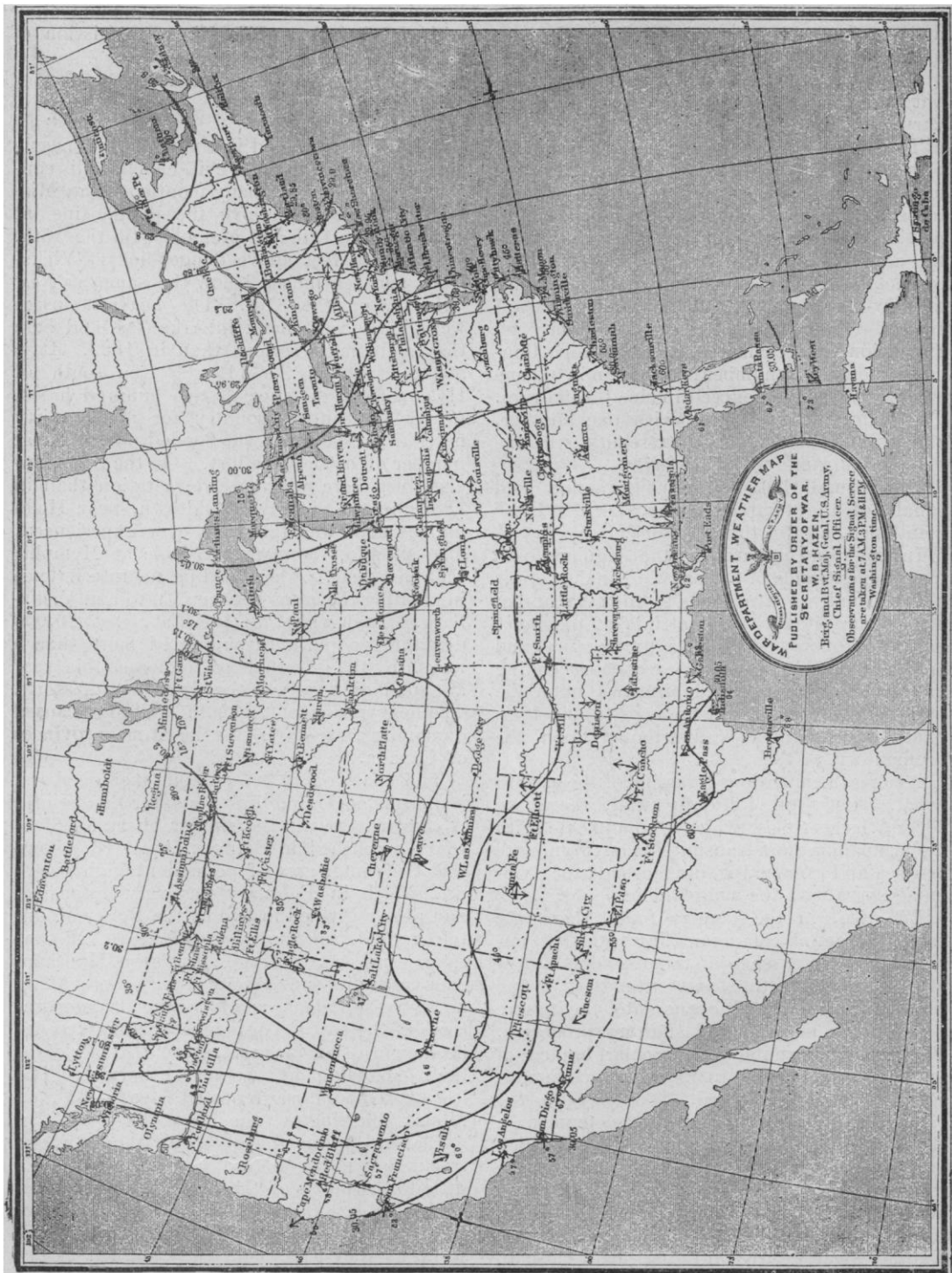
THE WEATHER IN MARCH, 1883.

The floods reported last month have nearly subsided, though their evil effects will continue to be felt for many months. The Mississippi remained above the danger-line at Cairo till the 12th; at Memphis, till the 15th. It was two feet above danger-line at Vicksburg, and ten inches below the same at New Orleans, on the 31st. The heaviest losses were on the west bank in Arkansas, and here they were more serious than in 1882. It is stated, that on the 11th, to the south of Helena for a distance of two hundred miles, nearly the entire country for about thirty miles from the river was flooded, and a great number of cattle were lost. On the St. Francis River there was more devastation than in 1882; in the vicinity of Oldtown, near Helena, the flood was the worst ever experienced. The situation is more favorable at Memphis than last year. There will be no interference in planting the crops between Cairo and Vicksburg. And while, in 1882, at least 20,000 destitute people were supported more than a month by the government, the losses this year are confined mostly to the drowning of stock. The heavy rains of the 20th and 21st caused damaging freshets in the maritime provinces of Canada.

The chart on p. 386 exhibits mean isobars, isotherms, and wind-directions, for this month. A comparison with the similar chart for February, published in SCIENCE, April 13, shows that the winter area of permanent high pressure, which in February was very extensive, and nearly divided in two by the Rocky Mountain range, had moved to the east of that range, and was central in northern Montana. This area, in connection with the prevailing north-west winds, accounts for the low temperatures of the east. These present a marked deficiency in all sections east of the 97th meridian, the mean being 3.2° below the normal. The lowest temperature reported was -34°, on Mount Washington, the 5th.

Eleven storms have been traced whose tracks lay either in the United States or a little to the north of the boundary. The following table exhibits the number and mean velocity of storms in each March since 1877, so far as they were sufficiently marked to enable a velocity to be determined.

¹ Mastoid sinuses.



MONTHLY MEAN ISOBARS, ISOTHERMS, AND WIND-DIRECTIONS, MARCH, 1883. REPRINTED IN REDUCED FORM BY PERMISSION OF THE CHIEF, SIGNAL-OFFICER.

March storms.

YEAR.	NUMBER.	VELOCITY, MILES PER HOUR.
1877	11	34.5
1878	10	24.3
1879	13	35.2
1880	14	35.8
1881	9	26.8
1882	10	34.9
1883	11	38.0
Mean . . .	11.1	32.8

Total movement of air in miles.

STATION.	1881.	1882.	1883.
Eastport	11,499	9,794	11,069
Portland, Me.	7,985	7,626	7,579
Boston	9,826	9,425	9,259
New York	9,848	8,176	6,820
Mean	9,789	8,755	8,682

Storm-tracks have also been drawn for the Atlantic: these show a much less stormy month than usual. During the first half, the movement of storm-centres was checked by an area of high pressure over the ocean, and extending from Europe westward to the 45th meridian. In consequence of this high area, easterly and south-easterly winds prevailed, thus favoring vessels bound westward. The lowest pressure reported was 29.1 inches, to the south of Newfoundland, on the 27th.

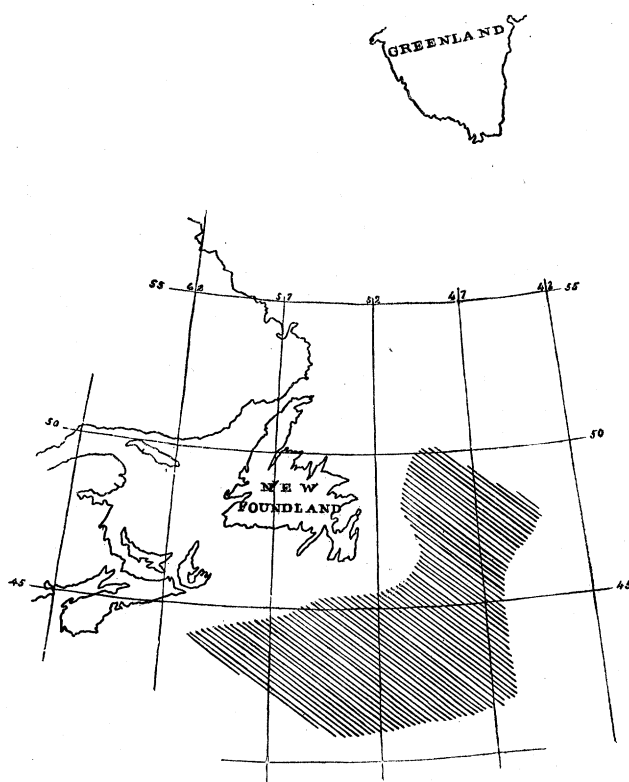
Icebergs and field-ice were most numerous in the parts of the ocean indicated by the shaded portion of the accompanying map, which shows the southern and eastern limits of icebergs in the North Atlantic, based on the reports of shipmasters, *New York herald* weather-service, and data published by the *New York maritime register*.

The precipitation was markedly less than in previous years; all sections east of the 97th meridian exhibiting a deficiency, except the South Atlantic States, +.4; Florida peninsula, +1.4; and the western Gulf States, +.6. The mean deficiency for this whole region was .76 inch. The threatened drought in the Pacific States, as noted in February, was broken by rains in the latter part of this month. These were sufficient to assure the success of the wheat-crop. Five feet of snow in the streets of Montreal were reported on the 7th.

The table in the next column gives the total movement of the air in March at several stations.

These figures show, with only a single exception, less movement during the present month than for three years. The air moved at the rate of 1,123 miles per day, or 34,800

miles during the month, across Mount Washington; and velocities above 100 miles per hour were reported on the 6th, 7th, 10th, 14th,



18th, and 25th. In the latter case the wind reached 150 miles in an hour.

Cautionary signals to the number of 117 were displayed; and of these, 115, or 98 %, were justified.

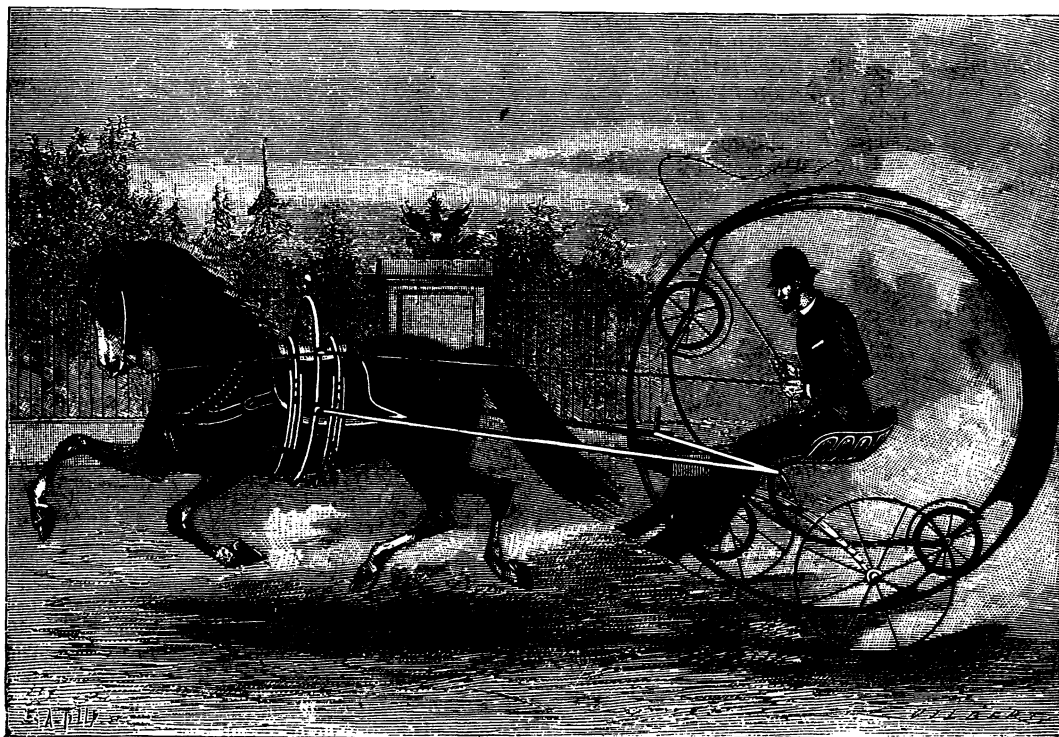
Auroras were seen on nearly every day of the month, but none very brilliant. The most extensive occurred on the 1st, 2d, and 3d. Professor Todd of Amherst reported sunspots, least in number on the 3d; and most, about the 24th. Earthquake-shocks were reported from Waterloo, Canada, between 10 and 11 A.M., of the 11th, and at 6.57 P.M., of the

same date, at Fallstown, Ind. On the 30th a wide-spread shock was felt in California.

*L'HIRONDELLE.*¹

This name we find given to a carriage which is the result of one of the recent attempts to gain for the ordinary road-vehicle the ease of traction which a rail gives. It might be better to say that the actual result is the use of a

screen is furnished behind, to give protection from the mud and dust, which, carried up by the outer ring, would be dropped on the hapless occupant. To give the whole stability, there are two outriding wheels connected with the main part by springs, flexible enough to allow of the main weight being borne by the central wheel, and yet sufficiently stiff to prevent any overturning. The most of the parts are made of wrought iron or steel. It has been found that the carriage is not liable to



L'HIRONDELLE.

much larger wheel than any that can be used in the ordinary way, and so the advantage which a large wheel gives in passing over obstacles on a rough road. The form shown in the cut is said to have been used in Poland and Russia with considerable success, and carriages of this type to have made their appearance in Paris. The driver's seat is connected rigidly with the shafts and with the three small grooved wheels which are made to fit the inner surface of the large steel ring, or wheel proper, which rolls on the ground. A

accident, and, with ordinary care, may be kept in running-order.

*THE GREAT COMET OF 1882.*¹

THE accompanying sketches are intended to give an idea of the appearance of the nucleus of the great 1882 comet, in the 26-inch Washington equatorial, on the evenings of Feb. 1, Feb. 23, and Feb. 27, 1883. A magnifying

¹ This article, and the cut accompanying it, are taken from *La Nature* of April 14.

¹ Communicated by permission of Vice-Admiral Rowan, superintendent U. S. naval observatory.

power of about 200 diameters was used on each occasion for making the sketches.

Fig. 1 shows the comet on Feb. 1, 1883, at about the time of meridian transit, or 9h.,

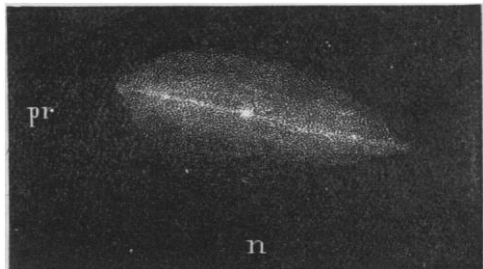


FIG. 1. Feb. 1, 34, 1883.

Washington mean time. The nucleus which I first saw in any degree 'separated,' on the morning of Oct. 7, 1882 (its entire length at that time being about 25"), has now stretched out into a fine straight line of light, with three quite bright and stellar-like points of condensation. No micrometer measures were made; but, from a rough estimate, the distance between the two preceding points was about 35", and the distance from the middle to the following point about 42", the total length of the nucleus proper being about 80". The middle point was the brightest. The head shows no very definite outline, but on the south side it is somewhat brighter and more sharply defined than on the north.

Fig. 2 shows the comet on Feb. 23, 1883, just after meridian passage, or about 8h., Washington mean time. I can see but little change in the appearance of the nucleus since the first of the month, or, indeed, since the first part of December, except a gradual diminution in brightness. Three bright points are still visible. The middle one is brightest, and

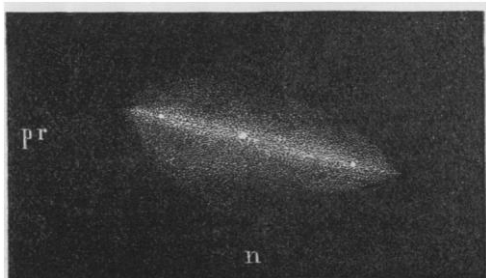


FIG. 2. Feb. 23, 34, 1883.

about equal to a star of the twelfth magnitude; the point preceding is a little fainter than this;

and the point following is the faintest. The light seems to be more concentrated near the preceding end. The position angle of the following point from the preceding was 76.5°; but the poor seeing and the increasing moonlight rendered it impossible to make any accurate measurements of the distance between these points.

Fig. 3 gives the appearance of the comet on Feb. 27, 1883, at about 8h. 30m., Washington mean time. The seeing was remarkably good, and the nucleus was examined with magnifying powers of 200 and 383 diameters. Four bright points were seen distinctly, and a fifth (following) suspected. Numbering these points of condensation in their order from the preceding end of the nucleus, 3 is decidedly the brightest, 2 next, 4 next, and 1 the faintest.

Professor Hall made a number of measurements of the distances of these points, and he has kindly furnished me with the following results of his observations:—

$$\begin{aligned} 2 \text{ to } 3 &= 34.5'' \\ 2 \text{ to } 1 &= 48.1'' \\ 3 \text{ to } 4 &= 22.3'' \end{aligned}$$

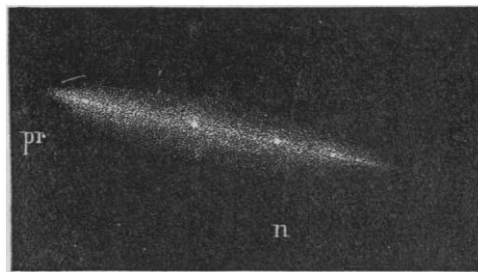


FIG. 3. Feb. 27, 36, 1883.

Position angle of the line joining 1 and 4 = 78°. This gives for the distance between the extreme points 1' 44.9". Using a value [0.45885] for the logarithm of the distance from the earth, interpolated from Professor Frisby's ephemeris, the apparent distance between our extreme points of condensation is 135,000 miles. If, however, these points lie on a line pointing from the sun, as this line makes quite a small angle with the line of sight at the time of observation, the real distance of our two points is about three times this value, or, roughly, 400,000 miles.

The comet was last observed on the 3d of March, but it is hoped that further observations can be obtained after the moon has passed.

W. C. WINLOCK.

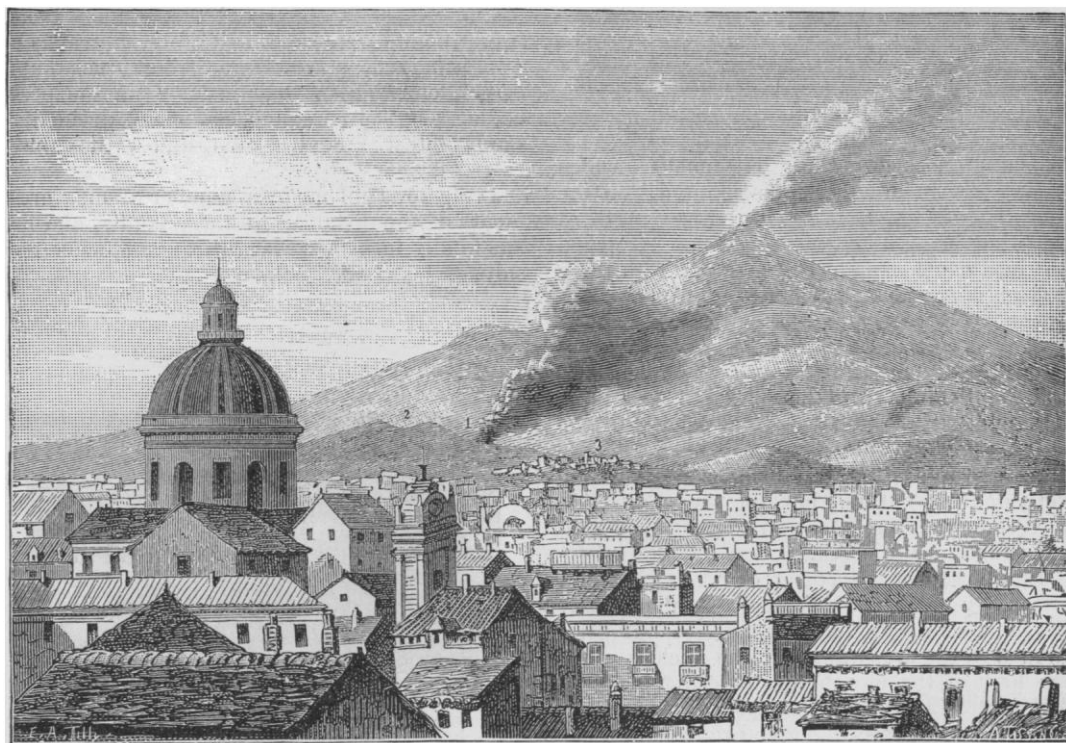
THE ERUPTION OF MOUNT ETNA.¹

THE last eruption of Mount Etna, although slight, has some interest, in that it was at a point farther down the mountain than any other in recent times, and the only one which has occurred on the southern side in this century.

The first warnings of the threatening eruption came from a series of earthquake shocks on the morning of March 20. Low underground sounds were heard, the reports suc-

ceeding one another at intervals of a few minutes. It was not until evening that it became evident where the eruption was to take place. At that time flames broke forth on the lower part of the southern side, about on the edge of the cultivated zone, and four kilometres north of the village of Nicolosi. Large clouds of vapor and gases escaped from cracks in the earth, and enveloped the mountain in a dense fog. By night-time a very red and bright light, which, viewed from Catania, appeared to play in large waves around the

foot of the mountain, announced the appearance of lava. Eleven cracks formed during the night; and from them were thrown scoriae, which formed three heaps forty to fifty feet high. One jet of scoriae was thrown out with such violence that the shock caused the bells in the villages of Nicolosi and Pedara to ring. The consternation of the people was the greater, as the locality was the same as that of the great eruption of 1669. This point commands a sloping plain which is highly culti-



ERUPTION OF MOUNT ETNA, MARCH 22, 1883. VIEW TAKEN FROM CATANIA.

1. The point of eruption; 2. Monti Rossi; 3. Village of Nicolosi.

ceeding one another at intervals of a few minutes. It was not until evening that it became evident where the eruption was to take place. At that time flames broke forth on the lower part of the southern side, about on the edge of the cultivated zone, and four kilometres north of the village of Nicolosi. Large clouds of vapor and gases escaped from cracks in the earth, and enveloped the mountain in a dense fog. By night-time a very red and bright light, which, viewed from Catania, appeared to play in large waves around the

vated, and on which are living, within a short distance of the centre of the eruption, a population of twenty thousand.

The second day the character of the eruption became decidedly alarming. Some new fissures opened near Nicolosi, and the lava spread out in large waves over the neighboring country. This made the outlook very threatening; but, to the great surprise of all versed in the history of volcanic action, the eruptive movement began to abate, and during the night stopped entirely. This was fortunate, as the overflow of lava was from a point which might have caused great injury.

¹ Reproduced, with some modifications, from *La Nature* of April 14, together with the illustration.

The fact cannot be concealed, however, that the eruptive apparatus of this last upheaval has been left in a state which furnishes a constant menace to the neighboring villages. On account of the sudden cessation of action, the secondary phenomena have not taken place, by which nature usually brings about a permanent end to these parasitic craters. It is, then, among the possibilities of the near future, that another eruption may take place on the same spot where the late one has proved abortive.

MAGNETO-MOTIVE FORCE.

"Faraday compared a magnet to a voltaic battery immersed in water;¹ and he established by experiment the principal analogies on which this comparison is founded." Mr. R. H. M. Bosanquet, from whom the above is quoted,² thinks that too little has been made of this analogy, which seems to him to furnish the only sound view of magnetism. He would speak of a permanent magnet as possessing a certain 'magneto-motive force,' which, acting through a circuit made up of the magnet and the bodies or medium surrounding the magnet, produces throughout this circuit a total magnetic induction, equal to the quotient of the magneto-motive force by the 'magnetic resistance.' So-called magnetic substances are those in which the *magnetic conductivity* is great; and bodies of this sort, when brought near a magnet, become parts of the magnetic circuit, whose resistance they lessen, just as masses of metal placed in the water forming part of an electric circuit would lessen the total electrical resistance of such a circuit.

Moreover, a new distribution of the lines of magnetic induction is brought about by the entrance of the magnetic body into the field; this body receiving and transmitting a larger proportion of the lines of magnetic induction than the space it now occupies received and transmitted when filled by air. The body is now said, in ordinary terms, to be magnetized. At the same time, the lines of magnetic induction, being deflected from their most direct course, and bunched together where they approach the magnetic body to enter it, encounter in that region an increased air-resistance. A like condition of things exists in the air-region where they are departing from the magnetic body; and the effect of these increased air-resistances is to make the number of lines of magnetic induction through the body less than it would otherwise be. This air-resistance near the surface has for its equivalent in the ordinary theory the 'demagnetizing' action which the induced magnetism of a body exerts upon the interior particles of the body itself.³ In the case of a very thin disk, magnetized by induction in a direction normal to its surface, the ordinary theory says that the demagnetizing action of the free magnetism of the surfaces almost neutralizes within the disk the effect of the external magnetizing forces, so that the magnetic induction in the disk is scarcely more intense than that in the air about it. The other theory explains the fact by saying that the superior magnetic conductivity of the disk is not able, acting for so short a distance, to seriously affect the course of the lines of induction in its neighborhood by making it advan-

tageous for these lines to bend from their normal course in order to pass through the disk.

Mr. Bosanquet's article is an attempt to prepare Faraday's theory for use in numerical calculations by furnishing it with exact quantitative definitions, and to show by the results of experiment that the theory is fitted for such work. In doing this he thinks it necessary to make essential changes in well-known and widely received formulas.

Mr. Bosanquet states the ordinary theory thus: "Now, the fundamental hypothesis at the base of the ordinary mathematical theory of magnetism is, that there are magnetizing forces $\mathfrak{H}$ which are of the dimensions of the magnetic induction $\mathfrak{B}$ which they produce, and that the magnetizing force permeates every medium, and produces in magnetic media magnetic induction proportional to the force and to a co-efficient of permeability μ , quite independently of the existence of any magnetic circuit." To this Mr. Bosanquet objects; one of his objections being, that "we have to suppose that the magnetizing force $\mathfrak{H}$ within a magnetic body has the power of remaining separate and distinct from the magnetic induction as a whole, though the two are quantities of the same nature." In his theory "the quantity $\mathfrak{H}$ becomes merely the magnetic induction in vacant space, and $\mathfrak{B}$ that in magnetic matter. $\mathfrak{B}$ replaces $\mathfrak{H}$, and is not supposed to include it as before."

Instead of remaining

$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{I}, \text{ or } \mu = 1 + 4\pi\kappa,$$

"our fundamental equation becomes

$$\mu = 4\pi\kappa, \text{ or } \mathfrak{B} = 4\pi\mathfrak{I}."$$

The formula

$$\mathfrak{B} = \mathfrak{H} + 4\pi\mathfrak{I}, \text{ or } \mu = 1 + 4\pi\kappa,$$

adopted by Maxwell and others, might, according to Mr. Bosanquet, lead to serious errors. Thus in a sphere of infinite magnetic permeability, magnetized by induction, Stefan, he says, has shown that "the ratio of the number of lines of force through its equatorial section to the number through the same section in air" is 3. Practically the same result is obtained from one of Thomson's papers, and Mr. Bosanquet confirms these results by a calculation in accordance with the views he is advocating.

He attempts now to show that Maxwell, using the formulas above, would make this ratio 4 instead of 3. A similar error would, he thinks, occur in calculating, according to Maxwell, the corresponding ratio for the case of a disk of infinite conductivity.

However interesting and suggestive certain parts of Mr. Bosanquet's paper may be, there is little doubt that he has here met the usual fate of those who attempt to convict Maxwell of error in reasoning. It is easy to show that Maxwell's formulas are in complete accord with the result above obtained from Stefan and Thomson. Thus (p. 66, vol. ii., old edition) Maxwell says that "in the case of a sphere the ratio of the magnetization to the magnetizing force is . . . , and if κ were infinite the ratio would be as 1 to 4.19," etc. This result Mr. Bosanquet quotes, but from that point he goes wrong. On the next page of Maxwell, where he is discussing the demagnetizing forces which the poles of a magnetized body exert upon the 'interior particles' of the body itself, we read, "If the magnet were a sphere the demagnetizing force would be $\frac{4}{3}\pi I$." The symbol I here, like $\mathfrak{I}$ in the formula above, means the intensity of magnetization.

Now, according to Maxwell, $\mathfrak{H}^2$ is not merely the original magnetizing force, which we will call $\mathfrak{F}$. It is this minus the *demagnetizing* force, which in this case is $\frac{4}{3}\pi I$. We have, therefore, from Maxwell,

¹ Exp. res., iii. § 3276.

² Phil. mag., March, 1883.

³ Faraday, Exp. res., iii., § 3289; Maxwell, arts. 426 and 438, old edition.

¹ Maxwell, art. 428.

² Maxwell, arts. 398 and 426.

$\mathfrak{B} = \mathfrak{S} + 4\pi\mathfrak{Z}$, $\mathfrak{S} = \mathfrak{F} - \frac{4}{3}\pi\mathfrak{Z}$, and $\mathfrak{Z} = \frac{\mathfrak{F}}{4.19}$;
whence

$$\mathfrak{S} = 4.19\mathfrak{Z} - \frac{4}{3}\pi\mathfrak{Z} = 0,$$

and

$$\mathfrak{B} = 4\pi\mathfrak{Z} = 4\pi \times \frac{\mathfrak{F}}{4.19} = 3\mathfrak{F},$$

which is the result reached by Stefan and Thomson.

A precisely similar line of reasoning applies in case of the disk; the fact that $\mathfrak{S}$ in both the sphere and the disk becomes 0 explaining how it happens that $\mathfrak{Z} [= \kappa\mathfrak{S}]$ remains finite, though κ is supposed infinite.

The fact seems to be, that Mr. Bosanquet does not understand the full meaning of Maxwell's $\mathfrak{S}$. He apparently supposes that it is the magnetizing force arising from external sources,¹ just what has been denoted above by $\mathfrak{F}$. Having, therefore, found that his own formula, $\mathfrak{B} = 4\pi\mathfrak{Z}$, gives, in the case of the sphere of infinite conductivity, $\mathfrak{B} = 3\mathfrak{F}$, he naturally concludes that Maxwell would obtain $\mathfrak{B} = \mathfrak{F} + 3\mathfrak{F} = 4\mathfrak{F}$.

The two above-mentioned cases, then, are of interest, not as showing the inaccuracy of the ordinary formulas, but as instances in which Mr. Bosanquet's formulas hold good. In any medium possessing finite magnetic conductivity only, i.e., in any known medium, Mr. Bosanquet's formulas will evidently lead to results different from those given by Maxwell's; and it remains to be shown, I think, that Maxwell is in error.

Indeed, it is by no means evident that Maxwell's formulas need be essentially changed in order to be in accordance with the requirements of the theory Mr. Bosanquet is advocating; for, though Maxwell preferred to speak of magnetization as an induction phenomenon, he was, of course, perfectly well aware of its analogy to conduction, as might be shown by numerous quotations from his treatise, of which only one need be given.

"In many parts of physical science, equations of the same form are found applicable to phenomena which are certainly of quite different natures, as, for instance, electric induction through dielectrics, conduction through conductors, and magnetic induction. In all these cases the relation between the force and the effect produced is expressed by a set of equations of the same kind, so that when a problem in one of these subjects is solved, the problem and its solution may be translated into the language of the other subjects and the results in their new form will still be true."²

E. H. HALL.

Cambridge, Mass., April 19, 1883.

THE SMALL PLANETS.

THE following statement of the condition of the prize question of the Royal Danish society of sciences appears in *Copernicus* for March, 1883:—

The number of small planets between the orbits of Mars and Jupiter has by degrees become so large, that it is not to be expected that it will in future be possible to compute, in advance, the motion of every single one. And it will even be less possible to compute their influence singly on the motions of the large planets or of comets. Fortunately, however, the masses of the small planets are so trifling that the perturbation caused by any one separately may be left out of consideration; but it is very doubtful

whether their collective influence might not be traced in the motion of the nearer planets or comets. In order that researches on this point should give a reliable result, it is necessary first to know the form and position of the ring formed by all the small planets, and the distribution of the masses in this ring.

No degree of accuracy can be attempted in the statistical description of the ring; and, with very few exceptions, the systems of elements already deduced for each planet may be adopted; the more so, as it will be of no importance whereabouts in its orbit a planet is at any time. As to the single masses, it is, of course, necessary to draw conclusions from the apparent brightness; but the number is so considerable that a fairly reliable result may be hoped for. In the statistical researches hitherto made, the separate elements only have been discussed, apart from their connection with the other elements; but this cannot be considered satisfactory. Thus the fact that the planets, arranged according to their mean distances, are divided into a number of distinct groups, does not, by any means, prove that the ring formed by them around the sun is dissolved into a number of fairly concentric rings.

The Royal Danish society of sciences, therefore, offers its gold medal (value 320 crowns, equal to nearly ninety dollars) for a statistical investigation of the orbits of the small planets considered as parts of a ring around the sun. The form, position, and relative distribution of mass, should, if possible, be stated with at least so much accuracy as is judged necessary for computing its perturbing influence on planets and comets.

The memoirs should be written either in Latin, French, English, German, Swedish, or Danish, and must be sent before the end of October, 1884, to the secretary of the society, Dr. H. G. Zeuthen, Copenhagen. They should not bear the author's name, but only a motto, while the name should be enclosed in a sealed envelope.

RESEARCHES ON THE DICYEMIDAE.

DR. C. O. WHITMAN has published an article¹ on these puzzling and imperfectly known parasites of the cephalopods. The number of genera is reduced to two, — *Dicyema*, with eight cells around the anterior end of the body; and *Dicyemennæa*, with nine. The number of species is increased to ten, all of which are carefully described. Three are new.

As these animals have been taken by Ed. van Beneden as the type of a new division of the animal kingdom, and as they have been the subject of much discussion, we reproduce Whitman's summary. The dicyemids may be divided, according to the share they take in the work of reproduction, into monogenic and diphygenic individuals. The first produce only vermiform, the latter, first infusoriform, and then vermiform embryos. It is doubtful whether the two kinds of individuals are heterogeneous forms; for they are alike in origin, development, and adult form and structure; but their germ-cells, for unknown reasons, pursue different courses of development. There is a relation, the meaning of which is unknown, between the age of the host and the condition of the parasites; the nematogens predominating in the young, the rhombogens in the adult cephalopods. The rhombogens alone have a plurinucleate axial cell, which then contains, first, its own large nucleus; second, bodies, probably correspond-

¹ Maxwell does, in art. 437, use $\mathfrak{S}$ in this sense; but he does not use it thus in his formulas.

² Art. 62, new edition.

¹ Mittheil. zool. stat. Neapel, iv. 1.

ing to polar globules, thrown off from the germ-cells before they develop into embryos; third, the 'residual nuclei' of the germogens set free, as the final event in the history of infusorogens. The infusorigen is a group of cells, consisting, at one period, of a peripheral layer of cells partially enveloping a large central cell. Its development from a single cell by a process of cleavage, and the epibolic growth of its peripheral layer, give ground for believing that it passes through a gastrula stage. In diphygenic individuals the germ-cells are different for the two kinds of embryos. The first to appear, one or two at a time, are the large germ-cells of the infusoriform embryos. After these embryos escape, there remain in the parent-body small cells, which multiply until they fill the greater portion of the axial cell, and eventually give rise to vermiform embryos. The difference between developmental division (cleavage) and multiplicative division of cells is here brought in striking contrast. No definite evidence of fecundation has been obtained, but it perhaps occurs with one form of embryo. In the development of the vermiform embryo, karyokinesis splits the germ-cell into two unequal parts. Then follows a three, and next a four celled stage, in which three cells form a cap over the fourth. This leads to a gastrula, in which a single entoderm-cell is enveloped by a small number of ectoderm-cells. The blastopore closes, and the multiplication of cells at this pole soon leads to the pyriform embryo, of which the pointed end is the blastoporal region; while the rounded end corresponds to the future cephalic pole. In this stage the first germ-cell appears at the hind end of the entoderm; the second germ-cell, at the anterior end; and from these two arise the other germ-cells. There is, therefore, a triploblastic stage, if we regard the two germ-cells as representing the mesoderm.

It may be added, that important errors of van Beneden have been corrected by Whitman, whose article is one of unusual interest and merit. As to the relationship of the dicyemids, Whitman says, "I see no good reason for doubting the general opinion that they are plathelminths, degraded by parasitism. Whether they, and their allies the Orthonectidae, have descended from ancestors represented now by such forms as *Dinophilus*, or from the Trematoda, is a question which further investigations must decide."

C. S. MINOT.

TEMPERATURE AND ICE OF THE BAVARIAN LAKES.

AFTER an account of temperature observations on Swiss lakes by earlier observers, as Brunner and Fischer, Simony and Forel, A. Geistbeck (*Ausland*, 1882, 961, 1006) gives a detailed tabulated statement of his observations during 1881 on sixteen Bavarian lakes, showing the following results. As to variation with depth, the first six metres are almost constant; between six and eighteen metres there is a rapid cooling; then, to fifty metres, a slow decrease; and, below this, an almost constant temperature of a little less than 5° C. Daily variation is distinct to six metres, but ends at eighteen. Annual variation is reduced to from 0.2° to 0.9° at the bottom of the deeper lakes. Two groups are noted. The warm lakes, with an average temperature of 7.3° to 17°, are less than one hundred metres deep, their bottom temperature is below 5°, and they have a decided annual variation through their entire depth. The cold lakes, Königs, Starnberger, Walchen, and Achen, are from 115 to 196 met. deep, and, below

fifty metres, are always cooler than 5°, with an average temperature of 5.2° to 5.6°: these have, therefore, a great volume of cold water even in midsummer, and a slow and small annual temperature range. The cause of this difference is seen partly in the depth of the lakes, and further in the relation of lake-surface to drainage-area, which, in the cold lakes, averages 1 to 10, and, in the warm, 1 to 30. Exceptions, here and elsewhere, to the rule of depth, are Barm (31.5 met. deep), Gosau (63), and Toplitz (105), which belong under the cold group; for, in spite of their moderate depth, they are well protected by steep shores from warming by sun and wind. On the other hand, Geneva (334) and Gmundener (190) approach the warm group, presumably on account of their large drainage-area. Certain small mountain-lakes, fed mostly by springs, show a relatively low summer and high winter temperature. Form of the bottom, and nearness to entering-streams, have strong control over the water's warmth. The lacustrine flora and fauna are determined chiefly by temperature and light. Reeds and algae are common along shallow shores, but all rooted plants end at a depth of twelve metres. The littoral molluscan and crustacean fauna disappears at twenty metres. In deeper water there is a special 'pelagic' fauna. (In this connection, see Forel, *La faune pélagique des lacs d'eau douce*, — *Arch. sc. phys. nat.*, viii. 1882, 230.)

The lake temperatures fall quickly in the autumn by circulation, but rise slowly in the spring by conduction and wave action. In winter a temperature lower than that of maximum density penetrates to a considerable depth: less than 3° has been found at forty metres. Ice forms first on the shallows along the shore, and spreads outward. The high lakes freeze every year, sometimes as early as October or September; the larger lower lakes, at later dates and more seldom. Walchen has frozen over only three times in this century; Constance, seven times since 1277; Gmundener, five times in the last four hundred years. In the severe winter of 1879-80 Tegern closed on Dec. 21; Zurich, in the middle of January; Walchen, on Feb. 3; and Constance and Gmundener, on the 6th. Changes of temperature produce long cracks in the ice, so characteristic as to have local names — *lehnen*, *schübe*, *wunen*, *frageln* — on the different lakes. Further description is given of the thickness and color of the ice, and certain peculiarities in the freezing of some of the lakes.

W. M. DAVIS.

LETTERS TO THE EDITOR.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Zoölogical 'regions.'

MY attention has been drawn, by a notice in one of the last numbers of SCIENCE, to what seems to me to be sources of error. I refer to the determination of zoölogical regions by percentage calculations, and the idea that regions should have a certain amount of numerical equivalence. This seems to be an artificial and hence fallacious method of dealing with the subject, engendered by the lack of a proper conception of the matter under consideration. No definition or description of a 'region,' or synonymous word, can be found in any of the leading works on zoogeography; but, if we put two and two together, an idea can be formed which will, I hope, help solve some mooted questions.

Regions are known to differ in the kinds of animals occupying them, as well as in location. All, or all but one, are geographically very distinct; and all are well

separated in regard to animal distribution. This latter point goes far toward being the sole cause of regions. Any large mass of land separated from the rest of the world will, in the course of time, become inhabited by a peculiar set of animals, and obtain a comparative balance or stability of life. Thus a number of species are evolved which forms a sort of compound whole, — the life of a region. So a region may be defined as the area occupied by a peculiar grouping of animals which are isolated from the life of the rest of the world; the word 'peculiar' referring to the animals as a whole, and the isolation as of a limited and not absolute degree.

Accepting the above definition, the world can be conceived of as divided into regions, which, if the land and sea remained at rest, would be permanent, but constantly growing more and more distinct. But the land is not permanent. While the main mass is a fixture, minor changes occur, which join and separate the continents. As soon as two lands are joined, unless some other very powerful barrier exists, the life of the two at once begins to blend. The more potent kinds survive, while the weaker die out. The first, together with the life modified by the new conditions (new species evolved), in the course of time form a single region. On the other hand, if a land become divided into two, the reverse takes place, and two regions are formed. To me the paleartic and nearctic regions seem to offer illustrations of both these processes; the connection for life having been made and broken between the old and new worlds, probably by means of Asia, more than once. At present it is broken; and the nearctic and paleartic regions are formed or forming from a previous circumpolar region. With the tentative definition given here, the two are regions, since they do not form a group, and are separated. No lack of percentage differences can make the life of the two regions closely related: a change in one does not necessitate a change in the other. This also answers the circumpolar question: the resemblance in zones is due, first, to the imperfect obliteration of the old circumpolar region; and, secondly, to the fact that some of the forms which inhabited it have been driven down into the southward-pointing peninsulas, where the conditions of their life are easier. According to this definition, Madagascar should be regarded as the remains of a fading region, rather than a part of the Ethiopian. The resemblance between Africa and India is due to a southward migration which occurred not so long ago, very likely on account of the ice age, from a northern central point.

The above crude suggestions would seem sufficient to show that regions are more than numerical relations, and have an evolution of their own.

J. AMORY JEFFRIES.

Panther Creek coal-basin.

I have just read your review of the Panther Creek atlas, in SCIENCE, No. 11, and my attention has been directed to what I consider a very just and proper criticism of two special features of the atlas sheets: 1°. The discordant scales of the mine (800' = 1") and topographical (1600' = 1") sheets. 2°. The use of the magnetic instead of the true meridian. As a geological critic, I should be disposed to boldly condemn what you have referred to as merely misfortunes. After an association of nine years with Professor Lesley on the Pennsylvania state survey, I am convinced, that, in the successful conduct of such a survey, it is quite impracticable to attempt to attain a purely technical and systematic standard of work. All that can be done is to approach as near as possible to such a

standard, while meeting the practical demands for geological results, to aid in the economical exploitation of our mineral resources. This latter is what has popularized the work of the Pennsylvania survey, and accounts for its uninterrupted continuance with liberal appropriations for a state survey, since 1874.

The published results of the survey so far relate mostly to topographical, geotectonic, and stratigraphical geology in their economical bearings, with the exception of two volumes on paleobotany. Had any other plan than that of Professor Lesley's, which he has so efficiently carried out, been instituted, the survey would never have been so liberally supported by our state legislature, and probably would have been discontinued several years ago. The important thing in a state survey is to do the best we can. If we attempt too much, we fail in all.

In regard to the discordant scales and magnetic meridian, I would say: 1°. That the publication committee of the board of commissioners has never before authorized the printing of *general maps* on a scale larger than 1600' = 1". This scale was found quite too small for the anthracite-mine sheets, and it was only after the most careful consideration on the part of the committee that a scale of 800' = 1" was adopted for the mine sheets. The smaller scale was unfortunately adhered to for the topographical sheets, on account of the cost of publication. 2°. In the Panther Creek basin, the magnetic meridian of 1869 is always used in all surveys; and the block-lines referred to this meridian on the atlas sheets have been similarly placed on all the large working mine maps. In this form the sheets are of much greater practical value for ready reference. Had the publication of this atlas been delayed until the completion of the astronomical determinations of the survey in this locality, we should probably not have obtained an additional appropriation to continue the survey, which we now feel assured of receiving.

CHARLES A. ASHBURNER,

Geologist in charge.

Philadelphia, April 21, 1883.

Crayfish.

In August, 1882, while in Fairmount Park, Philadelphia, I found a crayfish in a brook emptying into the Wissahickon Creek. It had its under parts covered with young crayfish about one-eighth of an inch long.

Professor Huxley says that the English species, *Asp. fluviatilis*, lays eggs in May and June, and the young leave the female in a few days; but the young staid ten days with the female after I found them. There seems to be a difference in their habits in this respect. Last Friday, April 6, I found a female crayfish with young ones clinging to it, which I caught; and a friend now has it in a tank. Do crayfish lay eggs both early in the spring and late in the summer?

RICHARD M. ABBOTT.

Trenton, N.J.

[The writer of the above is eleven years of age. — Ed.]

Marking geodetic stations.

The writer of the article in SCIENCE of April 13, 1883, p. 269, in referring to the method of marking the geodetic stations in the N. Y. state survey, makes the statement that the U. S. coast survey stations are indicated 'by no surface-mark whatever,' trusting entirely to the underground-mark for the preservation of the station. The writer has, doubtless, been misled by visiting a station from which the surface-marks have been removed by curious or malicious persons. In the coast survey the greatest stress is

laid upon the importance of carefully marking stations; and the detailed instructions in regard to the subject occupy two quarto pages in the manual 'On the field-work of triangulation,' issued by the survey. The most common method used is the one which has been copied by the N. Y. state survey. Other methods, however, are used in special cases. For recovering a station, the main dependence is upon the surface-marks, and the underground-marks are used only for protection in case of the destruction of the others by accident or design.

H. W. BLAIR,

Assistant Coast and geodetic survey.

Washington, D. C.,
April 22, 1883.

Freezing of liquids in living vegetable tissue.

The conclusions of Mr. Meehan in relation to the above topic (*SCIENCE*, p. 229) seem to me scarcely warranted by the best authenticated facts in vegetable physiology. Experimental investigations and researches, undertaken many years ago, led me to the following deductions:¹—

1. That the sap of many living plants can be frozen by the application of a degree of cold not much below that required to freeze it when removed from the plant; and that in very cold climates the sap of all perennial plants must be frozen in all parts during the winter months.

2. That the congelation of the juices of living vegetables does not, as many phytologists have imagined, necessarily and inevitably result in the death of the whole plant, or of the part in which it takes place, but, on the contrary, that frequently no injurious consequences follow. Consequently it is unwarrantable to assume that a plant which is not killed by severe cold never was frozen; and therefore it is unnecessary to invoke the aid of a 'vital power' to enable plants to survive the influence of cold sufficiently intense to freeze their juices when removed from the living plant.

3. That the bursting of the trunks of trees in high latitudes is not due to the expansion which the sap undergoes in process of congelation, but to the unequal contraction which takes place in the trunk (usually after the complete congelation of its juices) in consequence of a sudden depression of temperature. In short, that the rupture of the trunk in such cases is due to the same cause as the rents in the frozen ground, and the cracks in large sheets of thick ice, which occur in high latitudes when there is sudden accession of cold. This view is fortified by the fact that the coefficient of contraction (or expansion) of ice is greater than that of any other solid body hitherto examined, with the exception of hardened caoutchouc, or ebonite.

JOHN LECONTE.

Berkeley, Cal., April 17, 1883.

Sun's radiation and geological climate.

In his review of Whitney's climatic changes, Mr. Gilbert says, "His [Whitney's] hypothesis that the intensity of solar radiation is gradually lessening, by reason of the dissipation of solar energy, . . . will be admitted by most students." Mr. Whitney and his reviewer fall into the very natural error, that a loss of heat, and, of course, of energy, is necessarily accompanied by a fall in temperature. Paradoxical as it may appear, a loss of both heat and energy may

produce a rise in the temperature of the body that loses them. If it be true that the sun is, as is now thought by many eminent scientists, a globe of gaseous matter, then, under the long process of giving off heat, it has actually been growing hotter, and the intensity of its heat on the earth's surface to-day is greater than it was in the early geological epochs.

The world is indebted for this curious fact to Mr. J. Homer Lane.¹ I quote from Newcomb's *Astronomy*, p. 508: "The principle in question may be readily shown in the following way: if a globular, gaseous mass is condensed to one-half its primitive diameter, the central attraction upon any part of its mass will be increased fourfold, while the surface upon which this attraction is exercised will be reduced to one-fourth. Hence the pressure per unit of surface will be increased sixteen times, while the density will be increased only eight times. Hence, if the elastic and gravitating forces were in equilibrium in the primitive condition of the mass, its temperature must be doubled in order that they may still be in equilibrium after the diameter is reduced one-half."

Admitting, then, the gaseous condition of the sun, as, under our present knowledge, we seem compelled to do, we must also admit that the intensity of the sun's radiation of heat has been slowly increasing through the ages, and to-day is greater than at any previous time. The increase may have been small; but, so far as there has been any change, it has been in the direction of an increase, and hence cannot explain the undoubted decrease in the general temperature of the earth's atmosphere indicated by the paleontological record.

C. B. WARRING.

Distribution of public documents.

Few outside of the ranks of professional politicians will disagree with the report of the committee of Congress on the printing and distribution of public documents, or with the tenor of the editorial remarks on the subject in No. 9 of *SCIENCE*. But it is to be feared that it will be as difficult to induce the average congressman to dispense with these lubricants of the political machine as with the senseless distribution, through the department of agriculture, of seeds that can as well be bought at any country store. If any means can be devised by which the 'costly and beautifully illustrated volumes' shall reach those for whose information they were written, instead of serving to adorn the nurseries of influential ward strikers and campaign committee men, it will redound greatly to the benefit of scientific knowledge and progress; for at present it is mainly through the medium of second-hand book-stands that those interested can occasionally get the professional works of which their political insignificance did not render them worthy recipients.

There is one notable exception, however, to this extravagance and misdirection of precious documents, the result of one of those spasms of virtue mentioned in the editorial. I refer to the law concerning the distribution of the publications of the geological survey, to which director Powell has called attention in a circular issued some time ago. According to the terms of this law, these documents, excepting the general report, can be obtained only by purchase or exchange; that is, the scientific workers of the country may at first get what may be deemed the equivalent of their own publications, or, possibly, of rare works in their possession. But when this resource is exhausted, the only method open to them, for obtaining what in many cases is the sequel of

¹ For the exposition of the basis of these deductions, the reader is referred to the memoir of the writer, entitled "Observations on the freezing of vegetables, and on the causes which enable some plants to endure the action of extreme cold."—(*Proc. Amer. assoc. adv. sc.*, vi. 338-359; *Amer. journ. sc.* [2], xiii. 84-92, 195-206.)

¹ See *Amer. Journ. sc.*, July, 1870.

their own work in the states, is to purchase the memoirs out of their abundant professorial incomes. What that means when it comes to the illustrated memoirs and atlases, most needed by the actual worker, is too obvious to need discussion. They will simply have to be done without by those not within reach of a large public library.

Heretofore, a certain number of copies of such publications, outside of those placed at the disposal of congressmen, were distributed gratuitously to those known to be actively interested in the subject, by the authors, or heads of surveys, who knew exactly whom to reach among their scientific co-workers; and the stimulus thus given to research and scientific intercourse was very great. All this is now effectually embargoed: the very men whom these documents should reach are cut off from them by this penny-wise and pound-foolish legislation.

If it be true that the United States cannot afford to continue the expenditure involved in the gratuitous distribution of such costly publications, even for the encouragement of scientific research, it would be far better that their cost should be reduced from the magnificent quartos and royal folio atlases to such material and dimensions as *can* be afforded consistently with a judicious gratuitous distribution, intrusted, for example, to the judgment and discretion of the director, the Smithsonian institution, and the National academy, severally or jointly. The scientific publications would then be quite sure not to be wasted, and yet would with equal certainty reach those whose active interest in the progress of science should entitle them to their possession. This is the more needful, since the extension of the national survey into the states will, for the time being, undoubtedly render state surveys less numerous, and more scantily endowed for scientific work; so that the publications of the national survey will be the chief source of information hereafter. It does seem that what the states could afford to do gratuitously for their own citizens could be afforded by the national government, now that this kind of work has practically passed into its hands.

E. W. HILGARD.

Berkeley, Cal., April 19, 1883.

THE AGRICULTURAL EXPERIMENT-STATION OF CONNECTICUT.

Annual report of the Connecticut agricultural experiment-station for 1882. New Haven, State, 1883. 114 p. 8°.

THE major portion of this report is, as usual, occupied with analyses and valuations of commercial fertilizers, and divers other fertilizing materials, and though valuable in its way, and in accordance with the design of the station, contains little of general scientific interest. The review of the fertilizer-market for the past year, on pp. 56-60, must prove of considerable aid in the valuation of fertilizers, and will doubtless attract the attention of both manufacturers and consumers.

Among the fodder analyses are two of duplicate samples of field-corn and of fodder-corn, selected with especial care, and also of ensilage from the same material. These analyses dis-

closed the interesting fact, that the duplicate samples of the same material differed more in some cases than did the ensilage and the fresh substance. These results illustrate the great difficulties that stand in the way of preparing a fair sample of such a bulky plant as maize, and throw considerable doubt on the accuracy of some of the recently published results regarding the changes which maize undergoes in the silo.

The most generally interesting portion of the report is the paper on 'Milk,' by Dr. E. H. Jenkins, which includes the results of several analyses of the milk of single Guernsey cows, and of over two hundred partial analyses of the mixed milk of herds. These results afford valuable data in regard to the variations which may occur in commercial milk, and the possibility of establishing by law a standard of purity for milk. In regard to the variations in the milk-solids, "an inspection of all the results . . . leads to the conclusion, that, in pure herd-milk, the solids may in some cases, and at certain seasons, sink as low as 10 or 10.5 per cent, and the fat to 2.6 per cent; and that very frequently (in 28 per cent of the samples examined at this station) the solids are less than 12 per cent."

In one case the total solids amounted to only 9.79 per cent, though it was not *certain* that the milk was unadulterated, and, in six cases out of two hundred and seven, to less than 10.5 per cent. Dr. Jenkins comes to the following conclusions regarding the standard of purity for milk:—

"As evidence of watering, simply, specific gravity furnishes by far the most satisfactory test; and, if 1.029 is adopted as a minimum, no pure milk will be condemned. In some cases moderately watered milk may escape detection.

"If we will establish a minimum limit for the percentage of solids and fat which shall in no case condemn pure milk in any locality, we shall have to make it absurdly low, and thus offer a premium on watering milk of good quality."

While evidently doubting the practicability of establishing a general standard of purity for milk, Dr. Jenkins thinks it possible to establish by mutual consent *local* standards for limited districts, where the pasturage and other conditions are tolerably uniform. Where this is done he would not have the question of the *purity* of the milk raised at all, but would simply condemn all which falls below the standard as too poor to use. Both suggestions seem worthy of general consideration.

FOSSIL BOTANY.

Cours de botanique fossile fait au Muséum d'histoire naturelle. Par M. B. RENAULT. 2ème année. Paris, Masson, 1881. 194 p., 24 pl. 8°.

IN the first volume of this remarkable work, which was reviewed in this country a year since (*Proc. Amer. phil. soc.*), the author has exclusively considered the Diploxyleae, and given the history of each of the families of that class, — the Cycadeae, Zamiae, Cycadoxyleae, Cordaiteae, Paroxyleae, and Sigillariae. As the question of the relation of the Paroxyleae and Sigillariae is of the greatest importance for the history of the evolution of plants, it has been considered again in this year's course, though, in the preceding, the structure of the Sigillariae had been already examined. The author therefore proposes to study the most highly organized vascular cryptogams, and to search by studying the anatomy of the stems, the branches, and the roots, if, as has been asserted, any of them, at a certain point of their existence, take on the phenogamic character so distinctly that a separation of these two great divisions becomes impossible.

The essential characters of the vascular cryptogams to be examined are presented in a table. They are divisible into two prominent groups: 1°. The Lycopodiaceae and the Rhizocarpeae, which are heterospores, though some Lycopodiaceae are both heterospores and isospores; 2°. The Ophioglossae, the Equisetaceae, and the ferns, which are isospores.

The first group of the Lycopodiaceae is that of the Lepidodendreae, beginning in the first chapter with the genera Psilophiton and Lepidodendron. Chapter 2 examines in detail the anatomical structure of three types of Lepidodendron; viz., *L. Rhodumnense*, *L. Harcourtii*, and *L. Justieri*. Chapter 3 relates to the anatomy of the fructification of Lepidodendron or to the Lepidostrobi. Chapter 4 gives a brief examination of the characters of the other genera referred to the Lycopodiaceae. Chapter 5 compares the distinctive characters of Sigillaria and Lepidodendron, the differences, after discussion, being set forth in a comparative table; the Sigillariae being recognized as related to the phenogamous plants, and the Lepidodendreae to the Lycopodiaceae.

To the Rhizocarpeae belong, at the present epoch, the genera Pilularia, Marsilia, Salvinia, and Azolla. Of these, no remains have been found in the carboniferous; but species of the genera Sagenaria and Sphenophyllum seem to be related to this family. The history of the genus Sphenophyllum, as heretofore known,

and the description of the species, are given in chapter 6. The anatomical structure of Sphenophyllum is discussed in chapter 7; the woody axis is always full, not hollow, and inflated at the articulations only when a branch is formed; the stems, the leaves, the bark, the roots, the fructification, are treated.

With chapter 8 begins the treatment of the cryptogamous isospores, which may be summarized as follows: Equisetaceae. — The living plants of this family have only one kind of spores; examination of the stems and other organs. Asterophyllites. — Tiges, branches, and principal species described; two forms of fructification described (*Wolkmannia* and *Macrostachya*). Chapter 9. Annulariae. — Description of the different organs; stems, branches, and fructification; and of the species. Chapter 10. Fructification of Annularia, considered with species of uncertain relation (*Bruckmannia* and *Cingularia*). This chapter ends with a comparative table exposing the characters of the Asterophylliteae and the Annulariae. Chapter 11 contains descriptions of the genera *Schizoneura*, *Phyllothea*, and *Equisetum*. Nine species of *Schizoneura* and twenty of *Equisetum* are described, none from the paleozoic formations. The genus *Calamites* and its different organs are described in chapter 12.

The concluding chapter contains a table showing the different formations where the plants described in the volume have been obtained. The true Equisetaceae do not appear lower than the trias. The range of Asterophyllites, Annularia, Calamites, and the Lycopodiaceae, is from the upper Permian to the culm or subcarboniferous measures; that of Psilophiton is in the Devonian and upper Silurian. The volume ends with considerations on the distribution of the plants, on the climate as indicated by their nature, and on certain organs which may be useful in classifications. It would be useless to eulogize this excellent work, which is illustrated with twenty-three splendid plates. The above summary sufficiently shows its importance.

A NEW CALCULATION OF THE ATOMIC WEIGHTS.

Die atomgewichte der elemente, aus den originalzahlen neu berechnet. Von Dr. LOTHAR MEYER und Dr. KARL SEUBERT. Leipzig, 1883, Breitkopf & Härtel. 246 p. 8°.

THE great importance to chemistry of an exact knowledge of the atomic weights is well illustrated by the recent activity of chemists in

that line of investigation. About two years ago, Prof. G. F. Becker published his 'Digest'; a year later my own 'Recalculation' appeared; and now comes a third volume on the subject by Professor Lothar Meyer and Dr. Karl Seubert of Tübingen.

A comparison of this new work with the other two shows, that, in general terms, it is intermediate between them in its character. Becker collected the data relative to atomic weights, and brought them into systematic shape, but attempted no thorough recalculation. Meyer and Seubert classify and recalculate the published weighings, and make many valuable reductions of apparent weights to absolute or vacuum standards; but, with a few exceptions, they do not attempt to combine the work of different investigators, and they reject the method of least squares as inapplicable to the data at hand. My own effort was to reduce determinations as far as possible to common standards, to combine all similar data into general means, and to compute from all the evidence the most probable values for the atomic weights of the different elements. In so doing, I applied the method of least squares, and I see as yet no reason for discrediting that manner of discussion. Each of the three volumes fills a definite place; and, in any future revision of the field, each will be found a useful supplement to the others.

In general, the results obtained by Meyer and Seubert differ but slightly from mine. In comparing the atomic weights of sixty-six elements, the difference between the two recalculations falls within a tenth of a unit in thirty-seven cases, and is greater than a tenth in twenty-nine; but among the latter are found most of the rarer and less perfectly known metals. In many instances the differences are due to a trifling fundamental difference in the value assigned to oxygen. The Meyer-Seubert value is $O = 15.96$; mine is $O = 15.9633$; and this slight variation in the third and fourth decimal places sometimes is multiplied among the higher atomic weights to an appreciable amount. Where the two recalculations agree, they serve to confirm each other: where they differ, they indicate the important fields for further investigation. Most of the differences, however, are mainly due to differences in the manner of computation.

In some respects the new recalculation is open to criticism. Inasmuch as Meyer and Seubert rarely attempt to combine the available data, they are, perforce, compelled, in dealing with each element, to select more or less arbitrarily the results of one investigation, and give

it preference over all the others. This they do without assigning reasons for their choice; and such a lack of critical statement is much to be regretted. Again: the arrangement of the material is inconvenient, notwithstanding the fact that there is a well-classified index, both for elements and for authors. For example: aluminum, instead of being discussed in a division by itself, is treated in separate ratios on pp. 22, 23, 83, 139, 151, and 193; and a comparison of the results of different investigations is thus rendered a very troublesome matter.

Some omissions are noteworthy, and seem difficult to explain. Such, for example, are Cleve's determination of the atomic weight of scandium, Julius Thomsen's synthesis of water, and Russell's hydrogen series for cobalt and nickel. Russell's work on the oxides of these metals is given, and his results receive final acceptance; but wherein they are preferable to those of Lee is not stated. Another curious set of omissions occurs under antimony. Here are cited Professor Cooke's latest bromide series, and his set of results comparing the trisulphide with the chloride. But his syntheses of sulphide from the metal, and his valuable iodide series, are altogether ignored, while his earlier bromide series barely receives mention. Finally, nothing is said concerning Dumas' investigations upon the occlusion of oxygen by silver, although no recalculation of the atomic weights can safely ignore so important a factor.

F. W. CLARKE.

WILDER AND GAGE'S INTRODUCTION TO ANATOMY.

Anatomical technology as applied to the domestic cat: an introduction to human, veterinary, and comparative anatomy. By BURT G. WILDER, B.S., M.D., and SIMON H. GAGE, B.S. New York and Chicago, A. S. Barnes & Co., 1882. 25+575 p. 1. 8°.

This book the authors state to have grown out of their needs as instructors of students preparing for practical work in human, veterinary, or comparative anatomy. To students of the first and second of the above classes there is no doubt it will prove extremely useful. It is probably correct to say, that, although containing a good deal of irrelevant matter, and blemished by the unnecessarily extensive employment of a novel terminology, it contains by far the best set of directions for the dissection of a mammal below man in the scale, ever published for the use of that large class who prefer or are compelled to enter

on professional study without any thorough preliminary training. The bodies of horses or oxen are large and costly for elementary work, and, owing chiefly to defective legislation, in many states anatomical material is apt to be scarce in medical schools. Hence, for many years, good directions for the anatomical study of some easily obtainable mammal of convenient size have been a desideratum. The lad who has properly dissected a cat knows already a good deal of human or equine anatomy. He has not to learn, in his so often disgracefully brief medical course, how to use his scalpel; he knows what a humerus and a cerebral hemisphere are; iliac artery and median nerve are not strange and unmeaning names to him. In consequence, he can from the first profitably confine himself mainly to those special points in human, equine, or bovine anatomy, which have direct bearing on the future practice of his profession.

For those who intend to study comparative anatomy, or who have a year or two to devote to preparatory scientific studies before entering a medical school, we cannot agree with the authors that the cat is a good animal to begin with. By those students who desire some scientific anatomical knowledge, and have time and opportunity to acquire it, so high a type as the mammalian ought only to be taken up after thorough study of several lower and simpler forms. It is in connection with this fact that we think it unfortunate that the authors have made such unsparing use of new names. To the scientific student a simple and uniform terminology, applicable to all vertebrates without confusion, is worth the trouble of learning. But the great majority of those who will find this book useful will be lads desiring to acquire some knowledge of anatomical technique and phraseology as an aid to future professional, specialized, non-scientific study of the body of man or of certain domestic animals. It would surely be better for this purpose that (to take an example) students should learn to know, read, and speak of the cavities in the encephalon as the ventricles of the brain, the name under which they will find them in their professional text-books, rather than be taught to call them *procoelia*, *diacoelia*, *epicoelia*, and so forth. So far as the employment in the laboratory of the book itself is concerned, we must add, however, that the nomenclature and terminology employed have proved much smaller obstacles to its usefulness than we expected. When we first got hold of it, and read such directions as 'dorsiduct the tail,' and such statements as 'the cranium is the

caudal part of the skull,' we feared that the class on whom we proposed to try it would have a bad time. The men did grumble a little at first, but very quickly got to interpret easily all the new adjectives used in the text, and even to like them as facilitating brevity of description. This experimental evidence of the value of the nomenclature adopted may outweigh the apparent disadvantage of teaching students to call things by names which they will rarely if ever afterwards hear applied to them.

The first eighty-six pages of the book are occupied with introductory remarks on anatomical technology, and things in general. Many of them will be of great value to students who have to work without the supervision of a teacher; and also make the book a good one to put in the hands of a laboratory servant. It is very convenient to have directions for preparing injections and preservative liquids, for keeping the animals in good health, for anaesthetizing or killing them, and for cleaning and sharpening instruments, collected and printed as we here find them. There is, however, in these useful introductory pages, a considerable amount of superfluous matter. It may be necessary, though we doubt it, to inform the reader what is a fair price for a good scalpel or from what firms in the United States he may buy a suitable pair of scales; but an account of the metric system and metric bureau, and of good methods of exciting interest in metric measurements, is out of place in a dissector's handbook: a table of comparison of the ordinary and the metric weights and measures is quite enough. A discussion of the rules of simple arithmetic would have been as suitable, as an appendix to the formulae for interconverting the Centigrade and Fahrenheit thermometric scales, as is the account given of the metric system. Similarly, most of the 'Rules and aphorisms of general application' are about as much in place in an anatomical text-book as would be the sermon on the mount: they are admirable of their kind, but one is puzzled to know what they are doing in this gallery.

The book, however, is, in spite of some oddities, an honest piece of work, and will have permanent value: it is a real contribution to our knowledge of cat anatomy. Though many of its novelties in nomenclature are we believe unnecessary, and subjects are discussed which have no pertinence to the matter in hand, yet it will most undoubtedly prove of great use to a large class of students, and, we will add, to all teachers of vertebrate anat-

omy. We only wish the publisher had done as well as the authors. The illustrations are numerous, and probably sufficient to fulfil the end of helping the student in his work; but, from an artistic point of view, they are, with rare exceptions, simply atrocious.

MINOR BOOK NOTICES.

Guesses at purpose in nature, with especial reference to plants. By W. POWELL JAMES, M.A. London, 1883. 192 p. 12°.

This is a little book of ten chapters, which has just reached us, and which we would notice with a word or two in addition to an announcement of its title. The author, we fancy, is a clergyman and merely an amateur naturalist. However that may be, his *guesses* are shrewd, and the way of putting them is taking. Considering the great number and variety of the facts he has collected,—the greater part from books,—he has fallen into few mistakes; so that the volume has more scientific value than is usual in such treatises.

An outline of qualitative analysis for beginners. By JOHN T. STODDARD, PH.D., professor of chemistry in Smith college. Northampton, Gazette printing company, 1883. 4+54 p. 16°.

The general plan of this work will doubtless

be recognized as one which gives the best results in teaching qualitative analysis. To a certain extent it is faulty in detail, both as regards convenience of arrangement and the selection of methods. Although this criticism applies more especially to the course of basic analysis, if advantage were taken of differences in solubility of certain barium, calcium, and silver salts of the acids, it would save the student much time and labor in general analysis. An appended list of the names and symbols of the more common reagents will be found useful.

A short course on quantitative analysis. By JOHN HOWARD APPLETON, A.M., Brown university. Philadelphia, Cowperthwait & Co., 1881. 183 p., cuts. 12°.

The course of analysis presented in this work consists, with few exceptions, of a judicious selection of methods and determinations. The descriptions of processes and apparatus will undoubtedly be of much service in the laboratory, although considerable descriptive chemistry is introduced with which the student is supposed to be familiar before undertaking quantitative analysis. An exception will probably be taken to the completeness of the notes and explanations, which leave little opportunity for thought or study on the part of the student.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

Alignment curves on the ellipsoid.—Mr. C. H. Kummell describes several curves that represent the straight line, all of which, on the sphere, reduce to the great circle. The *vertical section* is traced by the surveyor at one end, who fixes points in range with the other end. The *proörthode* (πρό, ὁρθός, ὁδός) results, if the alignment at each point is determined at a point previously fixed, the distance between the two being infinitesimal. It is followed in chaining, or more roughly by the pedestrian in moving toward an object. In these two curves no back-sight is taken: they are differently related to the two ends, and do not return upon themselves. The *diorthode* (διά) is the locus of all points at which the vertical plane through one terminal point also includes the other. It is used in laying out primary base-lines, the points of which are determined by making fore-sights and back-sights differ always by 180°. This curve has been confounded with the preceding by Dr. Bremiker (*Studien über höhere geodäsie*, 1869) and others; but the proörthode is everywhere tangent to the vertical plane passing through one terminal point, while the diorthode, except at the ends, is not. The curve of shortest distance between two points, often called the 'geodetic line,' would more properly be called the *brachisthode* (βραχιστορός). These names were suggested by Mr. W. R. Galt of Norfolk, Va.

Mr. Kummell shows the diorthode to be the inter-

section of the ellipsoid with a hyperboloid of one sheet. In the case of an ellipsoid of revolution, this is the parabolic hyperboloid. Taking the three principal axes, a, b, c , as axes of x, y , and z , he represents the points where the chord connecting the two termini of the proposed alignment pierces the planes xy, xz, yz , by $(x_z, y_z, 0)$, $(x_y, 0, z_y)$, and $(0, y_x, z_x)$, respectively, and introduces quantities, —

$$a_b^2 = 1 - \frac{a^2}{b^2}, \quad a_c^2 = 1 - \frac{a^2}{c^2},$$

and so, by cyclic permutation of letters, β_c^2 and β_a^2 , γ_a^2 and γ_b^2 ; where the ratio of each of his first set of auxiliary quantities to one of his last gives one of the co-ordinates of position of those generatrices of the hyperboloid which are perpendicular to the co-ordinate planes. The equation of the hyperboloid is, —

$$\left(x - \frac{x_y}{\beta_a^2}\right) \left(y - \frac{y_z}{\gamma_b^2}\right) \left(z - \frac{z_x}{a_c^2}\right) = \left(x - \frac{x_z}{\gamma_a^2}\right) \left(y - \frac{y_x}{a_b^2}\right) \left(z - \frac{z_y}{\beta_c^2}\right),$$

and it passes through the centre of the ellipsoid.

The diorthode cannot be traced practically, because of the curvature of the earth. Mr. Kummell has investigated the locus of all points through which one tangent line meets the normals drawn at the two extremities, and finds its intersecting surface to be of

the fourth degree. — (*Phil. soc. Wash., math. sect.; meeting April 26.*) [811]

PHYSICS.

Electricity.

Testing insulation of electric-light wires. — Mr. C. J. H. Woodbury described a compact piece of apparatus, consisting of a magneto-electric machine and a pair of electric bells. The machine will produce a current strong enough to ring the bells through a resistance of seven thousand ohms. By connecting one pole with the electric-light system, and the other with the ground, the insulation of the system may be shown to be more or less than about seven thousand ohms, according as the bells ring or not. The method has been found useful in the inspections now made in the interest of fire-insurance companies. — (*Frankl. inst., meeting April 18.*) [812]

Electrical transmission of power. — Dr. C. W. Siemens, in the course of an address at the Institution of civil engineers on March 15, after describing the well-known experimental electrical railways of the Berlin and Paris exhibitions, stated that an electrical railway six miles in length had just been completed in the north of Ireland. In this instance the two rails, three feet apart, were not insulated from the ground, but were joined electrically by means of copper staples, and formed the return circuit, the current being conveyed to the car through a T iron, placed upon short standards, and insulated by means of insulate caps. For the present the power was produced by a steam-engine at Portrush, giving motion to a shunt-wound dynamo of 15,000 Watts, or 20-horse power. The working-speed of this line was restricted by the board of trade to ten miles an hour, which was readily obtained, although the gradients of the line were decidedly unfavorable, including an incline of two miles in length at a gradient of 1 in 38. It was intended to extend the line six miles farther, in order to join another railway system. The electric system of propulsion was, in the lecturer's opinion, sufficiently advanced to assure practical success under suitable circumstances; such as for suburban tramways, elevated lines, and, above all, lines through tunnels. The lecturer, however, did not advocate its prospective application in competition with the locomotive engine for main lines of railway. — (*Nature*, March 29.) E. H. H. [813]

ENGINEERING.

Stadia reductions. — Mr. Arthur Winslow presented, and described the derivation of, tables for stadia reductions, which furnish expressions for horizontal distances and differences of elevation, corresponding to 100-foot stadia readings for 2" up to 30°, on the supposition that the rod be held vertically, and the stadia wires be equidistant from the centre wire. They are not mere reductions of inclined distances to their horizontal and vertical components, but embody certain corrections necessary from the facts, 1°, that with horizontal sights the length cut off by the stadia wires on the rod is not directly proportional to its distance from the centre of the instrument, but from a point at a distance in front of the object-glass equal to its principal focal length; and, 2°, that with inclined sights a correction has to be made for the oblique view of the rod. Both the distances and elevations in these tables are given in feet. They are adapted to use with a telescope whose object-glass has any focal length, and with a rod which is so graduated that the spaces cut off on it by the stadia wires are directly proportional to its distance from a point at a distance in front of

the object-glass equal to its principal focal length, differing in these respects from the tables issued by the engineer department, U.S.A. — (*Eng. club Philad., meeting April 7.*) [814]

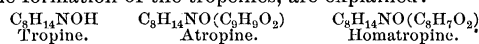
CHEMISTRY.

(Organic.)

Constitution of atropine. — A. Ladenburg proved that tropine is a tertiary base, since it would not unite with more than one molecule of ethyl iodide, and it was not affected by nitrous acid. By the action of chlorhydropasic acid upon it, a tropasate of tropine was formed; and, when treated with dilute hydrochloric acid, the latter substance was converted into atropine, which separated in beautiful crystals on evaporating the solution.

This product proved to be identical, in its chemical as well as in its physiological characters, with natural atropine prepared from belladonna. A series of derivatives, called by the author *tropelines*, results from the action of various organic acids with hydrochloric acid upon tropine. To establish the constitution of tropasie acid, it was prepared by the action of potassic cyanide in alcoholic solution upon chloracetophenon, and treating the product with baric hydrate. The resulting atrolactinic (or tropasie) acid was also made from hydropasic, and it was converted into atropasie acid. Since, furthermore, atropasie was converted into tropasie acid, the formula of the latter must be

$$\text{C}_6\text{H}_5\text{C}\begin{matrix} \text{CH}_2\text{OH} \\ \text{COOH} \end{matrix}$$
 When distilled with soda-lime, tropine is decomposed, giving methylamine and tropilidine (C_7H_8); and, when treated with fuming hydrochloric acid, a volatile base, tropidine ($\text{C}_8\text{H}_{13}\text{N}$), is formed. By the action of hydriodic acid and red phosphorus, hydrotropine iodide ($\text{C}_8\text{H}_{17}\text{NI}$) results. Tropine is thus shown to contain an hydroxyl group; and the above-mentioned synthesis of atropine, and the formation of the tropelines, are explained: —

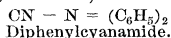
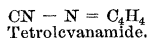


The tropelines are therefore ethers of tropine, which is a nitrogen-containing alcohol. When heated with bromine, tropidine is decomposed, with the formation of ethylen bromide and dibrompyridine ($\text{C}_4\text{H}_6\text{Br}_2\text{N}$). The author is at present engaged upon the synthesis of tropine from pyridine. — (*Ann. chem.*, cexvii. 74.) C. F. M. [815]

Protocattannic acid and anhydrides of the aromatic oxy-acids. — Hugo Schiff states, that, when protocattechuic acid in aqueous solution is boiled with arsenic acid, a substance is formed, with the formula of diprotocatechuic, or protocattannic acid ($2 \text{C}_7\text{H}_6\text{O}_4 - \text{H}_2\text{O} = \text{C}_{14}\text{H}_{10}\text{O}_7$). The solution possesses the general reactions characteristic of tannin; and mineral acids reprecipitate protocattechuic acid. When protocattechuic acid in ethereal solution is acted upon by phosphorus oxychloride, tetraprotocatechuic acid is formed ($4 \text{C}_7\text{H}_6\text{O}_4 - 3 \text{H}_2\text{O} = \text{C}_{28}\text{H}_{18}\text{O}_{13}$). The solution fluoresces, and its reactions in general are characteristic of tannin. If an intimate mixture of protocattechuic acid and dry arsenic acid is heated to 160°, a catelagic acid corresponding to elagic is produced ($2 \text{C}_7\text{H}_6\text{O}_4 - (\text{H}_2\text{O} + \text{H}_2) = \text{C}_{14}\text{H}_{10}\text{O}_7$). — (*Gaz. chim. ital.*, 1883, 90; *Berichte deutsch. chem. gesellsch.*, xv. 2588.) C. F. M. [816]

Action of cyanogen chloride on pyrrol-potassium. — By the action of dry gaseous cyanogen chloride on pyrrol-potassium, Ciamician and Dennstedt find that the cyanogen molecule is introduced, forming cyanpyrrol or tetrolcyanamide. This substance polymerizes at the point of fusion, with the formation, probably, of tetrolecyanuramide or tetrolmelamine,

3(C₆H₄N₂). The latter substance is not attacked by hydrochloric or nitric acid, nor by aqueous potassic hydrate. Sulphuric acid produces a brown color, which changes to black when the substance dissolves. Boiling alcoholic potassic hydrate gives pyrrol and an acid, probably cyanuric. Tetrolcyanuramide is analogous in structure to diphenylcyanamide, —



— (*Gaz. chim. ital.*, xxii. 102.) C. F. M. [817]

METALLURGY.

Delta metal. — An alloy has been perfected by Mr. Alexander Dick of London, which is composed of copper, zinc, and iron. If ordinary wrought-iron is introduced into molten zinc, it will be taken up by the zinc to about five per cent of the quantity of zinc. This product is then added to copper, or to copper and zinc, in the desired proportions. The resulting alloy is said to be as much superior to brass as phosphor-bronze is to gun-metal. It has great strength and toughness. When cast in sand, its tensile strength is 21 to 22 tons per square inch. When drawn into wire of 22 W. G., its tensile strength is 62 tons to the square inch. — (*Iron*, Feb. 23.) R. H. R. [818]

Metallurgy of the Incas. — At the meeting of the French academy on Feb. 6, M. Boussingault exhibited a bronze chisel harder than copper, but not so hard as iron, which was composed of 95 per cent copper, 4.5 per cent of tin, with traces of lead and silver. This tool is of a period previous to the conquest of the Incas by Spain. — (*Iron*, March 16.) R. H. R. [819]

Soaking-pits. — At the meeting of the Society of engineers, Feb. 5, Mr. Church, in his inaugural address, referred to the device of Mr. John Giers, which consists in placing ingots of steel directly in so-called soaking-pits. The ingot being thus surrounded by hot walls, the surface-heat is increased, and it is rolled by its own initial heat. This not only saves fuel, but avoids all danger of burning in reheating. — (*Iron*, Feb. 9.) R. H. R. [820]

Equalizers. — The Pittsburg steel-casting company places the ingots in square-shaped pits of fire-brick, six feet deep, three feet six inches square at the top, three feet at the bottom. On each side of the row of holes is a pair of Siemens regenerators for gas and air. The holes are heated to 2,000° F., and are filled with gas as a non-oxidizing atmosphere; and four ingots, weighing about a ton, are placed in each pit. The ingots being dark red or medium red outside and fluid inside, it is but a few minutes before they are equalized to a soft yellow, and are then in the best condition to roll to small billets, or to flanged rails. — (*Iron*, March 2.) R. H. R. [821]

AGRICULTURE.

Materials for manuring moors. — A paper by Fleischer describes the utilization of the sewage and garbage of the cities of Groningen and part of Bremen, for the reclamation and manuring of the surrounding moors. The materials are made into a compost, said to be comparatively inoffensive, and shown by analysis to have considerable value as manure, and sold, to be transported by water to the place of use. The paper is specially interesting in its bearings on the question of the utilization of city sewage. — (*Landw. jahrb.*, xii. 203.) H. P. A. [822]

Sewage irrigation. — Gersen discusses at considerable length the various systems of sewage irrigation, and the reasons of their failures, and proposes a new method, in which the sewage is distributed

over the surface to be irrigated in underground iron pipes under pressure, from which it is distributed by means of portable pipes. The ground may be flowed, or the sewage may be sprinkled upon it in regulated quantities. No levelling, and but little preparation of the surface, is required, and all open ditches or settling-basins are avoided. — (*Landw. jahrb.*, xii. 227.) H. P. A. [823]

Determination of available phosphoric acid. — Ollech and Tollens have continued the experiments by Grupe and Tollens on the use of citric acid as a reagent for the determination of available phosphoric acid. They recommend the use of a 1½-per-cent solution of citric acid, 5 grams of phosphate, and 500 cc. water, and show that the phosphoric acid in the resulting solution can be precipitated directly with molybdic solution. — (*Journ. landw.*, xxx. 519.) H. P. A. [824]

'Reversion' of superphosphates. — According to Post, the process of reversion takes place as follows: the free phosphoric acid acts first on undissolved tricalcic phosphate, forming monocalcic phosphate, and on iron and alumina, forming phosphates soluble in ammonium citrate. Later a double phosphate of iron and calcium or aluminum and calcium is formed, which is insoluble in ammonium-citrate solution. — (*Journ. landw.*, xxx. 573.) H. P. A. [825]

GEOLOGY.

Cape Hatteras. — Professor W. C. Kerr's studies in North Carolina have led to some interesting conclusions in regard to the geologic history of Cape Hatteras. The modern cape is a tract of low land which is, on one hand, losing altitude by subsidence, and, on the other, gaining it by accretion. The accretion is three-fold: first, sediment from local rivers; second, vegetable accumulation in a system of peat-forming swamps which occupy the divides between the streams; third, shore-drift, brought by the waves and currents of the Atlantic from the north and south. The shore-drift is derived from the sediment of the Susquehanna and other rivers, and is deposited in a continuous bank of sand, constituting the sea-front of the cape. The wind throws it up in dunes, which slowly travel landward, and eventually help to fill the lagoon, or sound, caused by the subsidence.

The history of the coast has not always been characterized by subsidence; for at various levels there are lines of shore-dunes and other coast features, which could have attained their present position only by an elevatory movement. One of the best preserved coast-lines has an altitude of less than 20 feet, and another, referred to the glacial epoch, lies at 500 feet.

When the ocean stood at the 20-foot level, the angle of the continental coast was at Cape Lookout, and before that it was at Cape Fear; but, though these great changes in the outline of the coast have occurred in very recent geologic times, the cape itself, considered as a salient of the continental margin, is not a modern phenomenon. It is at least as old as the cretaceous; and since it is an accretionary growth, dependent now on a certain combination of prevailing winds and currents, it affords presumptive evidence that a similar combination has characterized this part of the Atlantic for several geologic periods. — (*Phil. soc. Wash.*, meeting April 7.) [826]

Lithology.

The Lizard schists and serpentines. — Considerable study has been given to the Lizard district of Cornwall, during recent years, by Prof. T. G. Bonney, who seems now to be the best English petrogra-

pher. In the present paper he divides the schistose rocks into micaceous, hornblendic, and granulitic; and the microscopic characters of each group are given in detail. He endeavors to show the relation of the schistose rocks to the adjacent argillites, with which they have been supposed to be continuous. In the argillite he found a few fragments of the hornblendic rock, together with some felspathic fragments, which, he says, came from a metamorphic series. At another locality he found a fault (?) between the hornblendic rock and the argillite, at which the latter had been greatly broken. He states that the hornblendic rock here resembles a greenstone, but thinks he found in it signs of foliation and bedding. From this evidence he draws the conclusions that the argillites are younger than the metamorphic rocks 'by an enormous interval of time,' and that, while the former are devonian or older, the latter are azoic (archean).

Without objecting at all to his conclusions, one may point out the requirements to prove them, which he has failed to give. He has not proved the schistose series to be sedimentary, but admits that part may be eruptive, and that some of the series, at least, may be formed from volcanic ash. Until the series is proved to be sedimentary, the finding of supposed fragments of it in the argillites is no proof of difference in age; for eruptive materials are always apt to be embedded in the rocks forming at the locality at the time of the eruption. Bonney has further taken foliation as bedding, with which it may or may not correspond, and assumes that a metamorphic is synonymous with a sedimentary rock, when in reality eruptive, especially basic, rocks are more easily metamorphosed than most sedimentary ones; and the former make a large part of the so-called 'metamorphic rocks' in many regions of crystalline schists. Until Bonney gives evidence to prove that his series is sedimentary, his conclusions cannot be regarded as established merely because he considers the rocks sedimentary.

The serpentine rocks of the Lizard district had been discussed in a previous paper, but additional material is given here. Bonney holds that the serpentine is formed from the alteration of an eruptive peridotite. That serpentine is formed by the direct conversion of olivine rocks has been conclusively shown by the work of numerous lithologists; and, in this particular case, Bonney's microscopic observations bear out the general conclusion. That the Lizard peridotite was eruptive was shown by its forming dikes in the adjacent rocks, by its distorting and displacing them, and by its enclosing fragments of them. — (*Quart. journ. geol. soc.*, 1883, 1.) M. E. W. [827]

METEOROLOGY.

Thermometer-shelters.—There have recently been worked up and published the results of experiments, on a large scale, which were undertaken in 1869, by the Royal society of London, for the purpose of testing various thermometer-shelters. The experiments were made in a large open field at Strathfield Turgiss. Ten varieties of shelters were tried, eight of these being open, and two (Stevenson's and the Kew pattern) closed. It was found that all the open stands were subject to serious objections, as they gave varying results in different weathers. On the whole, the closed shelters were regarded as the better; and Stevenson's was preferred to the Kew, as the smaller and more easily handled. It is still thought, that, in dull weather, and for hygrometrical observations, this screen has not sufficient ventilation for the most accurate results. All the screens gave nearly uniform results for the mean tempera-

ture. Experiments are now in progress for comparing wooden with Wild's metallic shelters. — (*English quart. weath. rep.*, 1879.) H. A. H. [828]

Terrestrial radiation.—Professor Tyndall placed a thermometer upon cotton-wool which lay on the ground, and suspended another four feet above it. On Nov. 11, 1882, at 6 P.M., the readings were: wool, 26° F.; air, 36°. There was nearly a dead calm, — sky clear, and stars shining. The observations were repeated on Dec. 10, when, at 8.20 A.M., wool read 12°, and air 27°, with a clear sky, and very light wind. In both instances snow covered the ground. On many other days readings were made, and several of these with the sky perfectly clear, and with no visible impediment to terrestrial radiation; yet not one-fourth of the difference was observed that occurred on Dec. 10. Prof. Tyndall seeks to explain these results by the hypothesis, long since advanced by him, that the invisible aqueous vapor of the atmosphere in the latter cases interposes an effectual barrier to radiation, and hence the difference. It would seem as though a few observations of the amount of vapor would have assisted in establishing or overthrowing this supposition.

In a later number Prof. Woeikof discusses these observations, and suggests that the snow had a marked effect in reducing the temperature of the air just above it. He thinks that aqueous vapor has only a slight effect in checking radiation; not, however, in its gaseous state, but when condensed in small ice-crystals or water-droplets, even if, which is sometimes the case, it is invisible to the eye. He also suggests, that, in order to determine the real effect of aqueous vapor in terrestrial radiation, observations should be conducted in a climate, where, with a relatively great tension of vapor, the relative humidity is so small that there is no dew on clear nights, or, at least, it appears very late. Three thermometers, on cotton-wool, should be placed, one on the ground, and the others at heights from ten to a hundred feet above. If Prof. Tyndall's views be correct, the highest thermometer should show the lowest reading, as the aqueous vapor would impede radiation least from that one. He thinks there would be very little difference between the three thermometers. The matter is certainly worthy of careful experiment. — (*Nature*, Feb. 15, March 15.) H. A. H. [829]

PHYSICAL GEOGRAPHY.

Effects of deforesting in the Alps.—P. Demontzey describes, in a very well illustrated article, the injurious results following the cutting down of forests in the French Alps; these being chiefly the washing of great quantities of detritus down from the slopes, the rapid formation of gulleys and ravines, especially in the softer formations, and the inundation of good valley-land with sand and gravel. The extension of the torrential cone of the Rioubourdoux (Basses Alpes), where the mountain stream enters a broad valley, and several deep ravines, formed since 1830, on the branches of the Bourget, are excellently shown. The remedy adopted against further growth of the gulleys is to build numerous small dams across the side streams, and thus force the waters to drop their sediments, and build up their channels, instead of deepening them. Planting trees is to go on with this as fast as possible, to prevent the wearing of the bare hillsides. — (*La Nature*, 1882, 151, 183, 215.) W. M. D. [830]

Glacial erosion and lakes.—Rev. A. Irving has recently read two papers before the London geological society, — On the mechanics of glaciers, with special reference to their supposed power of excavation,

and On the origin of valley lakes, with especial reference to the lakes of the northern Alps, — coming to the conclusion that glaciers have not, and can not, cut out deep lake basins, although they may effect considerable general surface-erosion. Differential motions within the ice are regarded as consuming nearly all the gravitative and other force applied to the mass; so that an effective erosive motion of ice on bed-rock is small, and especially so in hollows where the motion is much retarded. The ice rather than the rock will yield when a stone is held between the two. Much rock-flour, washed away by the subglacial streams, may come from material carried down from surface-moraines. The author denies the force of Ramsay's argument that certain lakes cannot be explained save by ice-action, and thinks that certain possible causes were not sufficiently considered. Many alpine lakes are not at all where they should be, if formed by glaciers; and among the causes that may aid their formation are subsidence from underground solution, which recalls Playfair's old suggestion to account for Lake Geneva. This may be further aided by the simple weight of the ancient ice aiding to break down such undermined districts. Dislocations and folds, moraines, land-slides, and diluvial barriers, are also considered. Several special cases are referred to with some detail. — (*Quart. Journ. geol. soc.*, 1883, 62, 73.) W. M. D. [831]

Changes in the Mediterranean climate. — Dr. Th. Fischer, already known for his original studies in this direction, presents a brief statement of further work as supplementary to Tschischkoff's entertaining lecture before the British association last August (v. *Proc. roy. geogr. soc.*, 1882). His argument is based on the decline of population, shown by the numerous ruins in now desert regions of the northern Sahara, as well as in Asia Minor and farther east; on the barrenness of districts formerly cultivated, as is shown by the remains of irrigation-dams stretching across dry river-channels (*wadis*); on the occurrence in the Algerian desert of flint chippings covered by a thin gypsum layer, evidently the deposit of a spring, though the region is now wholly dry; and on the frequent occurrence of lightning-tubes in the dry sands, implying former frequent thunder-storms. In Algeria, the recorded annual rainfall from 1838 to 1849 averaged 800 mm.; from 1850 to 1862, 770 mm.; from 1863 to 1876, only 639 mm. The deforesting of the country is regarded as having aided this decrease. Furthermore, the absence of camels from old monuments in Egypt, the former occurrence of elephants in the northern Sahara, and use of horses and oxen in crossing the now desert region, — all bear witness to the same general decrease of rainfall. — (*Peterm. Mitth.*, 1883, 1.) W. M. D. [832]

GEOGRAPHY.

(*Arctic.*)

Aboriginal population of northern America. — A recently issued report on the Indians of the Dominion of Canada, together with the information collected by the tenth census of the United States relating to Alaska, affords the means of approximating to the aboriginal population of that part of North America, north of the boundary-line of the United States, as it existed in 1860. The Indian population of British Columbia, Manitoba (including the Northwest Territory), Athabaska, and Rupert's Land, being the regions where governmental supervision is non-existent or comparatively recent, is put at 78,264. Athabaska and Rupert's Land contain about 6,000, the remainder being nearly equally divided between the other two districts. In the older provinces,

where the whites and aborigines have long been in contact, there are 32,241 Indians. Ontario has 17,126; Quebec, 11,089; Nova Scotia, New Brunswick, and Prince Edward's Island divide the remainder. There is an increase, in the total number, of 2,783 over that of last year. There are, of the total Indian population, 81,634 reported as living on reservations or under supervision.

In south-eastern Alaska, 6,725 Indians are reported; Cook's Inlet, Kadiak, and Prince William Sound are estimated to contain 1,028. The Kuskokwim valley is allotted 147; and the Yukon basin, 2,226. These latter figures are probably under-estimates; but the total arrived at is 10,126.

Of the Orarian or Eskimo population of the shores of arctic British America no enumeration is yet possible. From Labrador to the Mackenzie mouth, probably not less than 6,000 are scattered in various localities. In Alaska there are 2,214 Aleuts. Of Inuit, properly so-called, there are estimated to be 17,488, which is likely to prove excessive, and thus in the total to correct the supposed under-estimate of the Indian population. Of these, about 3,000 are assigned to the Arctic coast; about 2,000 to Cook's Inlet and Kadiak; 7,500 to Bristol Bay and the Kuskokwim delta; and 3,300 to the Yukon delta. Taken together, this would give 25,702 Orarians, and 120,631 Indians; or 146,333 aborigines for the whole area. As estimation enters into the figures in several places, it may be said in round numbers, that the region probably contains about 150,000 aboriginal inhabitants, or 1 to 65 □ kilometres. — W. H. D. [833]

(*Asia.*)

Eastern Turkestan. — K. Himly's translation of the *Si yü shui tao ki* (Notes on the water-courses of the western district), a Chinese work written in 1824, is continued, but not yet concluded. The present number gives statistical description of the course and length of the Kyzyl, Yarkand, and other rivers, and numerous general and etymological notes. — (*Zeitschr. f. erdk. Berlin*, xvii. 401.) W. M. D. [834]

BOTANY.

(*Physiological.*)

Holdfasts in Podostemaceae. — It is well known that the river-weeds possess organs by which they cling to loose stones much as Fuci do. Warming calls attention to the presence of root-hairs on these and many other kinds of holdfasts, and he proposes to bring the various sorts under a single designation, namely, Haptera. While the term may prove useful, it must be remembered that under it are comprised at least two unlike plant-members. As they fulfil the same office, namely, clinging, they are physiologically similar, although morphologically unlike. — (*Botan. zeit.*, March 22.) G. L. G. [835]

Chemical constitution of certain protoplasmic bodies. — Zacharias, who has shown the curious chemical relations between the nucleus in plants and animals, and has pointed out the presence of phosphorus in the nuclei, has just given an interesting account of his studies in regard to the various contents of the cell in plants. Albumen, nuclein, and plastin are found in very different proportions in the different albuminoid bodies in the cell. — (*Botan. zeit.*, March 30.) G. L. G. [836]

(*Systematic.*)

Chapman's Flora. — The re-issue of Dr. Chapman's *Flora of the Southern United States*, which has long been out of print, is accompanied by a supplement of seventy-four pages, giving all the addi-

tional species that have been detected since 1860, the date of original publication. These additions comprise 64 genera and 383 species, besides 46 species and 19 genera that are certainly introduced plants. Rather more than half of these species are from Florida. No changes of any kind are made in the original text, a revision of which must probably await the completion of the Flora of North America. — s. w. [837]

Fern distribution in the United States. — The ferns of the United States now number 164 species (representing 32 genera), an increase of 39 in the last eight years. It is probable that the number is still by no means complete, and that others may be expected especially from the mountains bordering the Mexican boundary, and from the peninsula of Florida. Mr. Davenport gives a list of the known species, and their distribution among the states and territories. From his tables it appears that New York takes the lead in the number of species (52) that are credited to it, followed by California (48, with 4 others in doubt), Arizona (47, and 3 in doubt), Florida (47, and 2 doubtful), Michigan (47), Vermont (46), Pennsylvania (42, and 2 doubtful), Massachusetts (42), Kentucky (41, and 2 doubtful), Arkansas and Connecticut (41), etc. Six of the genera and twenty-four species are found only in Florida; one genus (*Schizaea*) is represented within the United States only in New Jersey; and, on the other hand, *Pteris aquilina* occurs in at least thirty-nine, and *Asplenium Trichomanes* and *Adiantum pedatum* in thirty-five out of the forty-eight states and territories. — (*Journ. Amer. phil. soc.*, Feb., 1883.) s. w. [838]

Araceae. — Dr. Engler continues his contributions supplementary to his monograph of the Araceae in De Candolle's *Monographia*, proposing two new monotypic genera, — *Synandropadix*, from the Argentine Republic; and *Oligogynium*, from tropical Africa. He approves of Baillon's adoption of *Richardia* as the older name of the Rubiaceae genus now generally known as *Richardsonia*, and follows him in the consequent restoration of Sprengel's name, *Zantedeschia*, for the 'Calla lily' (*Richardia Aethiopica*) and its congeners. — (*Engler's bot. jahrb.*, March, 1883.) s. w. [839]

(Fossil plants.)

Relations of *Lepidodendron*, *Sigillaria*, and *Stigmaria*. — A new memoir by M. Renault answers the critical remarks of Prof. Williamson and Dr. Hartog of Manchester, against the conclusions reached in his *Cours de botanique fossile* (see p. 397). The English anatomists find no marked difference in the composition of the wood of *Sigillaria* and *Lepidodendron*, which is, in both, of a single centripetal zone of tissue. Both are, therefore, true lycopodiaceous or cryptogamous plants. M. Renault considers the wood of *Sigillaria* as composed of two distinct zones; — an internal, of centripetal growth; an external, centrifugal, with distinct agglomeration of tracheae of the woody cords of the leaves, — centripetal in traversing the inner zone of the wood, centrifugal in passing through the secondary, which covers the trachean mass. This double woody zone relates *Sigillaria* to the Cycadeae or to the dicotyledonous gymnosperms. This last opinion has been already sustained by Brongniart. — (*Consid. rapp. Lepid. Sigill. et Stigm.*, Paris, Masson, 1883.) L. L. [840]

Tertiary flora of Australia. — From observations made at Dalton, New South Wales (eocene horizon), and in the Travertine of Hobart Town, Tasmania (miocene), Baron von Ettingshausen finds that the tertiary flora of Australia is far more nearly allied to

the tertiary floras of the other continents than to the living flora of Australia. It appears not improbable, therefore, that the numerous forms which characterize the latter have been developed out of pliocene or post-tertiary forms of plants, thus far unknown to geologists. The existence at the present time of characteristic non-Australian genera in the flora of the continent is traced back to the tertiary period, in whose deposits remains of such forms as *Fagus*, *Tabernaemontana*, and *Elaeocarpus*, have been discovered. — (*Geol. mag.*, April, 1883.) A. H. [841]

ZOOLOGY.

Protozoa.

Development of *Volvox*. — Miss S. G. Foulke presented a communication upon the development of *Volvox globator* and its separated gonidia or reproductive spores. It was stated that in one case some of the gonidia freed themselves from the protoplasmic envelope, breaking the connecting filaments, and swam away. In some instances these free gonidia passed into an encysted state; in others, attached themselves by the remains of the filament to other substances, thus using it as a footstalk, and presented the appearance of *Vorticella*. Many of the free gonidia remained in a free swimming state. Others remained in the *Volvox*, developed in *Amoebae*, and emerged, after enveloping and digesting some of the neighboring gonidia. These *Amoebae* afterwards took the form of *Amoeba radiosa*, and then returned to their former state, seeming to have the power of using either shape at pleasure. As the parent *Volvox* belongs to the microscopic Algae, or water-plants, the change of its spores to a form in all respects apparently identical with an animalcule furnishes another interesting illustration of the approximation of the lowest animal and vegetable organisms. — (*Acad. nat. sc. Philad.*; meeting Feb. 20.) [842]

Dimorphism in fossil Foraminifera. — MM. Schlumberger and Munier-Chalmas find that certain foraminiferal forms — otherwise undistinguishable from each other, except in the matter of size, and therefore specifically identical, as far as external characters alone would indicate — exhibit in the disposition of the central chambers some well-marked differences of structure, hitherto recognized as being of specific or even subgeneric value, but which appear to be entirely dependent upon the ages of the individuals concerned. In young individuals, as indicated by tests of small size, a relatively very large central initial chamber is distinctly visible; whereas, in the older or larger specimens, this chamber can only be determined by means of a powerful magnifier. This so-called dimorphism was found to obtain in both the perforate and imperforate groups, — in *Nummulina*, *Assilina*, *Biloculina*, *Dillina*, *Fabularia*, *Lacazina*, *Triloculina*, *Trillina*, *Quinqueloculina*, *Pantallina*, *Heterillina*. — (*Rev. scient.*, March 31.) A. H. [843]

Worms.

Anatomy of Terebellides. — The anatomy and histology of *T. Stroemii* M. Sars has been investigated by Steen at Kiel. The drawings on the three plates are too schematic in character to inspire absolute confidence. The published article takes the form of a complete monograph, but consists substantially of a detailed description of the external form and appendages, and of the internal anatomy and histology. The various organs are taken up in succession, and excellently treated; but the details are hardly adapted for a brief abstract, although they will be valuable in compiling a comparative histology. — (*Jena. zeitschr. naturw.*, xvi. 201.) C. S. M. [844]

Multiplication of worms by division.—Dr. C. Bülow has investigated the processes of transverse division in *Lumbriculus variegatus*, and the regeneration of parts to complete a new individual out of the pieces of the parent body. His article is prefaced by a valuable *résumé* of previous investigations. In *Lumbriculus*, besides the sexual there is a natural asexual propagation, by simple transverse division, occurring spontaneously. Head and tail, both or either, can be re-formed. There is no budding zone formed before division: the process is therefore different from that in *Nais* and the *Syllidae*. In both head and tail the segments are apparently newly developed from before backwards (*contra* Bonnet). The head and tail buds are formed within 48 hours after division; and, in a few days, defecation through the new tail-end may be observed. The re-development may be produced by artificial division. One individual was cut into fourteen pieces, of which thirteen grew up to complete individuals. (The paper would have been improved by much shortening and more careful arrangement.) — (*Arch. für. naturgesch.*, 1883, 1.) C. S. M. [845]

Anatomy of Prorhynchus.—J. von Kennel publishes an article on *Prorhynchus*, one of those doubtful genera of worms whose systematic position could not hitherto be satisfactorily determined. Kennel shows definitely that it is a rhabdocoelus turbellarian. It has a simple straight intestine, and muscular pharynx. The structure of the integument and parenchyma of the body is like that in other Rhabdocoela, and not like that of nemerteans. The same may be said of the nervous system. The penis lies well forward, and, before its structure and relations were correctly understood, was compared to the proboscis of nemerteans, with which it has no relation. It is armed with a spine, and has a muscular bulb at its base, which is connected by a somewhat tortuous duct with the vesicula, in which the products of the male glands are directly received. It lies ventrally from the pharynx. The stylet is exerted through the mouth. It is a very complicated apparatus, which the author fully describes. There are no separate yolk-glands; but these are united (unlike other plathelminths) in one mass with the ovary. This is the most important difference found between *Prorhynchus* and other Rhabdocoela. — (*Semper's arbeiten*, vi. 69.) C. S. M. [846]

VERTEBRATES.

Equilibration functions of the semicircular canals.—From observations on dogs with one or both auditory nerves divided, Bechterew concludes: 1°. Unilateral section is followed by forced movements of rotation around the long axis of the body, with deviation of the eyes, nystagmus, etc. 2°. The movements, at first constant, occur later in paroxysms separated by periods of rest. During the latter, the animal assumes a constrained position, lying on the opposite side to that of the section. Finally, the rolling movements altogether cease; but the animal has a tendency to exhibit circus movements towards the injured side, and has a deficient power of maintaining its balance on its feet. 3°. All the above symptoms are reflex, since they are still exhibited after removal of the cerebral hemispheres, or in narcosis. They are, however, more marked when the hemispheres are present. 4°. Section of both auditory nerves is accompanied by marked deficiency of the power of maintaining equilibrium. The animal can neither stand nor walk. 5°. When only one nerve is cut, the forced movements are due to a disharmony resulting from the absence on one side of

the normal semicircular-canal sensations, and their presence on the other. Hence the cerebellar equilibration-centres act abnormally; also, when the cerebrum is present, the uninjured side sends stimuli to the centres of consciousness, which, being unbalanced by the usual associated stimuli from the other side, lead to vertigo. 6°. The well-known action of auditory impressions in influencing movements (as in dancing and marching) occurs, in all probability, through the semicircular canals. — (*Pflüg. archiv*, xxx. 312.) H. N. M. [847]

Influence of the spleen on pancreatic digestion.—Twenty years ago Schiff published researches which led him to believe, that, after removal of the spleen, the pancreatic secretion lost its power of digesting proteids. His final conclusion was that, the spleen did not itself make the proteolytic ferment, but furnished to the blood something essential for its formation in the pancreas. Schiff's statement attracted but few adherents; and Haidenhain, in 1875, proved that a substance (zymogen) capable of yielding proteolytic ferment, accumulated in the pancreas quite independently of the presence or absence of the spleen. This seemed, at first sight, to completely overthrow Schiff's theory of the splenic function in digestion. Herzen now brings forward experiments which reconcile the apparently opposite conclusions. He claims that his researches on dogs prove that after removal of the spleen, the pancreas may still heap up zymogen (*trypsinogen*), but that this is not under such circumstances transformed into a proteolytic ferment (*trypsin*), as it is normally when the spleen is present and in physiological activity. Hence, after splenectomy, or in cases of serious splenic disease, the digestion of albuminous substances is greatly impaired. — (*Pflüg. archiv*, xxx. 295.) H. N. M. [848]

Mammals.

Early stages of the guinea-pig ovum.—Spee has published the results of his observations on this subject. Up to the beginning or middle of the fourth day, the ova remain in the oviduct, whence they must be carefully extracted. Eggs of two days have four segmentation-spheres, around and between which a coagulated mass soon appears *post mortem*. On the third day the limits of the cells are unrecognizable; but they may be more or less isolated by bursting the ovum. After the fifth day, the coagulum no longer appears around the segmentation-spheres. In all the early stages *post-mortem* changes are very great and rapid. While still free, after the fourth day, the ova lie in the tip of the uterus, whence they may be driven by forcing with a syringe a current of warm 0.5% salt solution into the vagina, and out of the tip of the uterus (after cutting off the oviduct). By employing this method, Spee has obtained germ-vesicles (keimblasen) agreeing essentially with corresponding stages as found in other mammalia, the principal difference being that the cells are relatively larger, segmentation not having progressed so far. There is an outer wall close against the zona pellucida, and composed of a single layer of cells, spindle shaped when seen in section, polygonal when viewed from the surface. At one pole is an accumulation of cells, the 'keimhügel,' while at the opposite pole the cells at the outer layer are thickened. In a later stage the cells of the latter pole are found to have thrown out branching processes which penetrate the zona pellucida. Apparently these processes increase in size; and it is probable that they make a hole through the zona by which the egg makes its exit. Spee has actually found, in one case,

an empty ruptured zona. This is an important and interesting observation, because the fate of the zona pellucida has not been hitherto determined. Spee adds the suggestion that possibly the same protoplasmic processes which serve to free the egg, also act to fasten it to the wall of the uterus.

As a continuation of Spee's paper, Hensen describes an ovum, soon after attachment to the uterine wall, found six days and twenty-three hours after copulation. The egg (0.13×0.08 mm. in diam.) lay in an open pit of the mucosa. It consists of a vesicle, with a mass of cells on one side, therefore agreeing in structure with the latest stage of the free ovum seen by Spee. Formerly Hensen considered the mass of cells to represent the ovum, and the wall of the vesicle to be an outgrowth of the epithelium of the uterus; but he now withdraws that interpretation, and accepts Schäfer's view that the whole is ovic. "The vesicle is therefore the single-layered primary chorion, which is derived from the ectoderm, and is separated very early from the embryo proper. In other mammals this separation does not occur until after the formation of the amnion." The ectodermal cells of the germ-mass of the embryo come to form a hollow, and this hollow Hensen homologizes with the amniotic cavity of other mammals. Of course, therefore, it is bounded by the ectoderm, and, beyond that, by the endoderm. The apparent reversal of the layers is therefore due to the early development and peculiar position of the amniotic cavity, inside the ovum. In conclusion, Hensen insists upon the importance of showing that the histological value of the germ-layers is really preserved, even in so unusual a form of development as that of the guinea-pig. — (*Arch. anat. physiol., anat. abth., 1883, 44, 61.*) C. S. M. [849]

Germ-layers and gastrula of the mouse. — In some rodents the germ-layers have apparently a position the reverse of that in other animals. This fact has led Selenka to investigate the early stages of white mice in the search for the explanation of the reversal. He has published a preliminary notice of his results. There is a special envelope of covering cells within which the cells of the embryo proper undergo their development. (This is perhaps the stage described by Spee — see 849 — in the guinea-pig, as a vesicle with a clump of cells at one end.) The embryo-cells lie at one end, separate into the two primitive layers, and become united with a support formed by a knob of cells attached to the uterine wall. This knob is not used in the construction of the embryo. The mass of ectoderm-cells becomes hollow, and the cavity increases in size. In the ectodermal cells limiting it, the ectodermal organs of the embryo are developed according to the typical processes in other mammalia. A more detailed report of this interesting research will be given when the full memoir is published. — (*Biol. centralbl., ii. 550.*) C. S. M. [850]

Embryology of mice. — The observations of Selenka and Kupffer on the development of mice have been critically reviewed by Hensen. He does not accept their views as to the gastrulation, or that the formation of the cavity bounded by the ectoderm is the gastrula development. Selenka attributes the reversal of the germ-layers to the proliferation of the ectoderm-cells; but Hensen maintains it to be due to the invagination of the mass of cells forming the embryo-germ. The ectodermal cavity in *Arvicula* does not correspond, as would seem natural, to the amniotic cavity of the guinea-pig; for an amnion is subsequently developed in its interior. (Does not this rather indicate that Hensen's homologizing the

ectodermal cavity in the guinea-pig with the amniotic cavity is erroneous, and that it is really the same as the ectodermal cavity described by Selenka and Kupffer?) Finally Hensen discusses briefly the position of the germinal disk in guinea-pigs, and compares it with that of rabbits. — (*Arch. anat. physiol., anat. abth., 1883, 71.*) C. S. M. [851]

ANTHROPOLOGY.

The Onondaga Indians. — In 1882 the legislature of New York appointed three commissioners to inquire concerning the condition of the Onondaga Indians; and their report has been published. With the feud between the the christian and the pagan parties, we have nothing here to do; but much interesting ethnologic matter appears throughout the pamphlet. On the reservation in Onondaga County are 319 souls, who, with others of their tribe scattered through the state, amounting in all to 500, constitute a nation, recognized as such in treaties and by the courts, holding their lands in perpetuity, not to be sold or in any manner disposed of, and regulating them entirely after their own fashion. The origination of the union of the Six Nations is detailed in Morgan's *League of the Iroquois*, and a brief sketch of their history is given in the pamphlet now under review. The Onondagas hold their land in common; but certain portions are held by individuals, and these possessions are bought and sold and leased to one another. Some of them are thrifty farmers, owning cattle, oxen, and horses, and they frequently monopolize the best lands. The old custom of frequent divorces has been partly broken up by the new constitution of the tribe; and the law now conforms to that of New York respecting the Indians, — that those who contract marriage shall be considered as lawful husband and wife, and their children shall be legitimate. In practice, however, there is just ground of complaint. The evidence before the commission shows that old practices are kept up in some of the Indian dances that are incompatible with civilization. To the report of the commission are appended the new constitution, and the complaints and charges of the two factions in the tribe. — J. W. P. [852]

Philologic science. — Dr. Frederick Müller, of Vienna, published, during the past year, parts 1 and 2 of vol. ii. of his *Grundriss der sprachwissenschaft*, devoted to the languages of the smooth-haired races. Part 1 is devoted to the Australians, the Hyperboreans, and the Americans; part 2, to the Malays and the northern Asiatic (Mongolian) races. Of the subdivisions of the Australian race, it is impossible here to speak. The Hyperboreans are made to embrace the Yenisei-Ostjaks, Yukagirs, Chukchis, Ainos, Aleuts, and Innuits. The American languages discussed are the Athapaskan, Algonkin, Iroquois, Dakotan, Cherokee, Chahta, Kolosh, Selish, Sahaptin, Chinuk, Mutsun, Nahuatl, Sonoran, Otomi, Taraskan, Tototen, Matlatsinka, Mixtek, Zapotek, Maya, Mosquito, Bribri, Arowak, and Carib, in North America; and the Moxos, Muisca, Paeses, Yaruros, Chimu, Inca, Guarani, Kiriri, Chiquitos, Lules, Abipones, Moluches, and Tehuelche, in South America.

Under the high Asian languages in part 2, Prof. Müller includes the Samoyede, Ural-Allaic, Japanese, Corean, Tibetan, Burman, Siamese, Khasian, Anamese, and Chinese.

In no case does the list of languages claim to be exhaustive; and especially is this true of North America. The plan with each tongue is to commence with the sound system, and, proceeding from a discussion of root-forms, to progress through the differentiation

of parts of speech and accidence, so far as this has taken place. [853]

Nomenclature of stature. — Dr. R. Fletcher read a note on Zoja's scheme for nomenclature, relative to human stature, of which the following table presents the main features: —

			Centi- metres.
Gigantosoma	Hypergigantosoma.	Phenomenal . .	251—supra.
	Gigantosoma . .	Giants	226-250
	Hypergigantosoma .	Gigantic	201-225
Megasoma	Hypermegasoma . .	Near gigantic . .	191-200
	Megasoma	Very tall	181-190
	Hypermegasoma . .	Tall	171-180
Mesosoma	Hypermesosoma . .	Above ordinary .	166-170
	Mesosoma	Medium	165
	Hypermesosoma . .	Below ordinary .	164-160
Microsoma	Hypermicrosoma . .	Low	159-150
	Microsoma	Very low	149-140
	Hypermicrosoma . .	Lowest normals .	139-125
Nanosoma	Hypernanosoma . .	Dwarfish	124-100
	Nanosoma	Absolute dwarf . .	99-75
	Hypernanosoma . .	Phenomenal . . .	74 et infra.

The observation was made, that the figures given are for Italians, and would have to be modified for each race of men. — (*Anthrop. soc. Wash.*; meeting April 17.) J. W. P. [854]

Through Siberia. — This is the title of a work by Henry Lansdell, first appearing in 1881, and issuing in a third edition, in 1882, by Houghton, Mifflin, & Co., Boston. The author's journey was overland through Tobolsk, Tomsk, and the southern part of Siberia, across the head waters of the great north-flowing river-systems of Asiatic Russia, to the mouth of the Amoor River. The chief motive of the trip was a study of prison-life in the countries visited; but works of this kind frequently reveal delicate flowers of aboriginal life and facts that are as welcome to the reader as their great value is unappreciated by the writer. The author gives a list of the stocks mentioned in the Russian map of this territory, as follows: Slavs, Zeryani, Voguls, Votyaks, Tatars, Kirghees, Karakalpaks, Sarto, Usbeks, Turks, Kalmuks, Teleuti, Ostjaks, Samoyedes, Yurakis, Yakuts, Tunguses, Goldi, Gilyaks, Yukagirs, Chukchis, Koriaks, Kamchadales, Ainos, Buriats, Manchus, and Chinese. The manner in which the ethnological information is scattered through the work renders it difficult to refer to that concerning any one tribe. Especial interest will be taken in the mention, on p. 26, of the Tatars, descendants of the followers of Genghis Khan. The ethnography of the Ob-Irtish valley, including Tatars, Russians, Voguls, Ostjaks, and Samoyedes, will be found on pp. 98-106, 124-126; that of the Yenisei, on pp. 205-210; that of the Yakutsk province, on pp. 296-308, with a short vocabulary on p. 305. In chapter xxviii. will be found an account of personal adventures with the Mongolian frontier races; and in chapter xxx., a description of the Burjats. Coming to the Amoor River, the Oronchons, or reindeer Tunguses, and the Manyargs, or horse Tunguses, meet the traveller (see pp. 507-511). Chapter xlii. introduces us to Manchuria and its inhabitants; and chapter xlii., to the Gilyaks and Goldi at the mouth of the Amoor; and the closing portion, to eastern Siberia, the Kamchatkals, and Sauhalins. The volume closes with a bibliography and a copious index. — J. W. P. [855]

EGYPTOLOGY.

Art in Egypt. — The influence of the earlier art of Chaldea and Assyria on art in Egypt, is the subject of a work by L. von Sybel, *Kritik des aegyptischen*

ornaments (Marburg, 1883), in which he takes the position, that, after the eighteenth and nineteenth dynasties, the art of Egypt was largely modified by the influence of Chaldean and Assyrian art. This, he asserts, is shown not only in decoration, but also in statuary of the human form. Perrot, though differing in some respects from the author, bears witness to his extended researches and his excellent taste. — (*Rev. archéol.*, Dec., 1882.) H. O. [856]

Color in Egypt. — "Egyptian color must be seen in Egyptian sunlight, which almost blots it out, or in the dim interior of an Egyptian temple, and then the strong contrasts of bright hues are very much sweeter and more musical than they seem to us. There is a gentle harmony in them. . . . It is impossible, without seeing a very fine Egyptian monument under the conditions of light in which the builders meant it to be seen, for us to apprehend their coloring, which certainly, when represented in pictures, or seen in our own generally diffused light, has an aspect of harshness, though the harmony of color is maintained in the use the Egyptians make of it. Take ivory and ebony, gold, lapis lazuli, green and red jasper, and let a great master make a mosaic in Egyptian style, and you would see how really grand it is, and how it has in it that large simplicity which connects it with the expression of durability. I think if you will study Egyptian decoration you will find this to be true." — (R. S. Poole, in '*Lect. on art*,' 1883.) H. O. [857]

EARLY INSTITUTIONS.

Institutions of early Rome. — M. Alfred Maury sums up the conclusions of Gen. Favé in his *Ancienne Rom* (Paris, 1880, 8°). The city presents itself at first as an aristocracy of free men (*ingenui*) governed by the heads of families (*patres*). It was an aristocracy of landlords and warriors. Below this aristocracy were the plebeians, who were clients of the patricians; at any rate, subject to them, and governed by them. Most of the land was in the hands of the patricians. The plebeians appear to have had only movable property, and not much of that. As in the feudal time, during the middle ages, war was regarded as the school of virtue; but it was a school for every class of free men (which was not the case in feudal times). The freemen went to war at their own cost, each man spending his own money in it. The burden of military service was very heavy for the poorer classes of freemen, and it was a principal cause of the pauperism and indebtedness of the plebeians, of which we read so much. The people were continually called out to war, and had no time left them in which to provide themselves with the necessary means of support. The writer describes the institution of paid forces and standing armies. This gave to Rome a great advantage over the other states of Italy, where the people were still called to war at their individual cost. The result was, that not only Latium, but almost all Italy, was soon subject to Rome. Colonies of Roman citizens were then planted in various parts of Italy, and, what was unprecedented, garrisons of soldiers were established to protect them. The other states of Italy did not protect the colonies which went out from them. The colonies were frequently quite severed from the mother-state. This was not the case with the colonies of Rome. They were the outposts of a military system. The arts of war and defence were constantly cultivated by the Romans. This was not the case in the other states of Italy, and they were easily conquered. Gen. Favé considers the early history of Rome from the military point of view. — (*Journ. des sav.*, Jan., 1883.) D. W. R. [858]

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Department of agriculture.

Facts of interest in economic entomology.—Bulletin 2 of the entomological division contains the following facts of interest:—

The Chrysomelid *Graptodera carinata* injured fuchsias by eating the leaves in September at Germantown, Penn. — During 1882 the army-worm was reported from Saratoga County, N.Y., at the north, to the Red-river valley in Louisiana, at the south. — The larva of *Agrotis inermis* is mentioned as cutting down smilax in an extensive flower-garden at Germantown, Penn. — The clover-leaf weevil (*Phytonomus punctatus*) was as destructive in Yates County, N.Y., in 1882 as in 1881; and its spread into adjoining counties was noticed. — *Ephestia zeae* was received from New-York City, with accounts of damage done by the larva to lozenges. — The description of the curious work of a mite allied to *Tetranychus tellarius*, found at Melrose Highlands, Mass., is given. A large ash-tree was almost entirely covered by a filmy web spun by this mite. — The little homopterous *Entilia sinuata* Fabr. was sent from Franklin Falls, N.H., as destroying the Canada thistle. — *Isosoma tritici* was received from Columbia County, Wash. Ter. — The fungus, *Scorias spongiosa*, upon the honeydew of *Schizoneura imbricator*, was sent from Johnson County, Tenn. — Twigs of *Wistaria* were received from Hudson, O., which were bored by the larva of *Elaphidion villosum*. — A letter from Mr. H. G. Hubbard, on the aid of spiders in the spread of scale-insects, is given in full. — The seventeen-year cicada appeared in 1882 in parts of Yates, Ontario, Livingston, and Wyoming Counties, N.Y. — A mill at Lansing, Mich., was overrun (November, 1882) by the two beetles *Palorus depressus* and *Laemophlaeus alternans*. — The natives of Upper Birman use, as a remedy for cotton insects, congee-water; i.e., fermented rice-water, with a little salt and the rind of a fresh squeezed lemon thrown in. — Mr. William Plumer of Lexington, Mass., advises the addition of a small quantity of gum-arabic or glue and bichromate of potash to insecticide solutions, in order to render them 'water-proof,' or less readily washed off by rains from plants or trees to which they have been applied. — The effect of frost upon scale-insects is considered in a letter from Mr. Joseph Voyle, of Gainesville, Fla., who concludes, that, by unusually cold weather, larvae killed, but not enough to be of service to the hatching and development are retarded, and a few tree.

PUBLIC AND PRIVATE INSTITUTIONS.

Astronomical observatory of Harvard college, Cambridge, Mass.

The work at the observatory. — There has been great progress in the reduction and publication of past observations. The catalogue giving the results of photometric measurements on four thousand stars is now in the hands of the printer.

Photometric observations of a hundred and eighty-five eclipses of Jupiter's satellites have been made. The search for objects with singular spectra has been continued and carried on with more system than formerly. At the last opposition of Mars, the satellites were seen, and photometric measurements were obtained which agreed with those made in 1877. The results of the photometric measurements of various points on the moon have been published in the *Sele-nographical journal*, v. 57. Mr. Chandler has made a

careful study of Sawyer's variable star, and has found the period to be about twenty hours. The variation of the light is about three-fourths of a magnitude.

Professor Rogers has found it necessary to take a prolonged rest from night-work, but will resume soon. The results of his work in the last twelve years will occupy three volumes of the *Annals*, and are being prepared for publication.

The measurement of the light of the stars visible to the unaided eye was completed last summer. Over ninety thousand measures were made on about four thousand stars. The effect of atmospheric absorption has been found, for any altitude exceeding 15°, to equal in stellar magnitudes one-fourth of the secant of the zenith distance. This agrees with the result of Seidel, the average deviation of the two determinations not exceeding one-thirtieth of a magnitude. An extended comparison of the scale of magnitudes employed by previous observers has been made. A reduction of the observations of Sir William Herschel has been effected, and has led to important results. Their neglect hitherto has been partly owing to the want of a suitable system of magnitudes by which they might be reduced. This want has been supplied by the photometric measures at this observatory. We have thus an accurate measure of the brightness of a large part of the lucid stars of a hundred years ago.

NOTES AND NEWS.

The fifth session of the congress of Americanists will be held in Copenhagen, Aug. 21-24, under the patronage of Christian IX., king of Denmark. Dr. J. J. A. Worsaae, director of the museum of ethnography, will be the president, and W. A. Carstensen, general secretary. A prospectus of the meeting has been published, and may be had from the president or the secretary. Any one remitting twelve francs to M. Tietgen, *directeur de la Banque privée de Copenhague*, will be entitled to a ticket of membership and a copy of the report. The subjects to be discussed are as follows:—

History and geology. — Discovery of America; The Northmen in Greenland; Mexican *calpullis*; Central American nationalities; Mexican and Peruvian military systems; The Popol Vuh; Comparison of the kingdoms of Cuzco, Trujillo, and Peru; Peruvian divinities, Viracocha, etc.; Migrations of the Caribs; Traditions of the deluge in America.

Archeology. — Kjökkenmøddings of Greenland and elsewhere; Sacred signs; Religious and emblematic significance of idols, etc.; Architecture of Peru.

Anthropology and ethnology. — Tribal synonymy and cartography; Kingdoms of Cibola, Quivira, and Tegnayo; Ethnology of New Granada and the Isthmus; North America and Central Asia compared.

Linguistics and paleography. — Grammar of the Eskimo compared with that of other American languages; Mexican languages and others compared; Decipherment of Maya inscriptions, and of quippos; Peruvian languages, and others compared.

— At the annual meeting of the Boston society of natural history, May 2, the following officers were chosen: president, Samuel H. Scudder; vice-presidents, John Cummings, F. W. Putnam; curator, Alpheus Hyatt; honorary secretary, S. L. Abbot, M.D.; secretary and librarian, Edward Burgess; treasurer, Charles W. Scudder. The report of the curator, Prof. A. Hyatt, gave a full account of the mineralogical collection, the re-arrangement of which has just been completed, and to which we shall soon refer more particularly. It was shown that it would be impossible to complete the arrangement of the other collections in similar manner, without additional income at the society's disposal. Considerable work was done in the geological collection, but its final arrangement will need at least a year's more work.

The trustee of the Lowell lecture fund has generously continued to support the Teachers' school of science, in which ten lessons had been given by Prof. W. H. Niles, on physical geography, and five by Dr. H. P. Bowditch, on physiology. Both courses were attended by large numbers of teachers. Laboratory instruction was also given to one class from the Massachusetts institute of technology, and one from the Boston university, besides two private classes; and during the summer, instruction was given to fourteen students in the curator's laboratory at Annisquam, Mass. In one dredging-trip specimens of Octopus and other interesting forms were brought up from about forty fathoms.

The secretary reported the additions to the library to amount to 2,065 volumes and pamphlets. Three parts of the proceedings and three of the memoirs had been printed, together with a new list of members.

Seven essays were offered in competition for the Walker prize of the year, — 'The life-history of any animal.' The committee awarded the first prize to Howard Ayers of Cambridge, for his essay on the development of the tree-cricket (*Oecanthus niveus*) and one of its parasites (Teleas). The committee requested further time for the consideration of the award of the second prize. The successful essay fills a hundred and twenty-seven manuscript pages, and is beautifully illustrated with thirty plates carefully drawn and colored. The author has attempted to establish or discuss the following points: for *Oecanthus*; the origin of the ovum in a germarium, the process of yolk-formation by cell-degeneration instead of secretion, a primitive segmentation of the embryo before the appearance of the permanent segments, the existence of a pair of appendages on each of the seventeen segments, the formation of the dorsal vessel as originally a paired organ (as in some worms), the existence of embryonic gills, the lack of any sharp distinction between a cell and its nucleus and between the latter and the nucleolus, the origin and significance of the embryonic membranes, and

the dorsal organ among insects; in Teleas; the absence of embryonic membranes, and the occurrence of an intermediate larval form between the blastosphere and the cyclops-larva of Ganin.

— At the close of its last session, Congress made provision for the co-operation of the United States in the researches proposed by the electrical congress at Paris in 1882. The secretary of state has designated as commissioners, on the part of this government, Professors Barker of the university of Pennsylvania, Trowbridge of Harvard university, and Rowland of Johns Hopkins university. The sum of \$12,500 was appropriated for experiments.

— The newly organized Royal society of Canada will hold a session in the parliament buildings at Ottawa, commencing May 22. Delegates from several scientific bodies in the United States are expected to be present.

— At a meeting of the Washington anthropological society, April 17, Dr. W. J. Hoffman made a comparison of Eskimo and Californian pictographs by means of charts, by which he showed the relation between these figures and the sign-language of the North-American tribes. A wonderful familiarity with the gesture-speech enables Dr. Hoffman to read many of the pictographs with perfect readiness. Mr. J. Curtin, who has spent much time in diplomatic service in Russia and Hungary, and has brought home a rich treasure of the folk-lore of the regions in which he has travelled, read a paper on Scandinavian and Magyar folk-lore. Dr. Fletcher explained Zoja's scheme for the nomenclature of stature, given elsewhere in this issue.

— By the system of railway time recently recommended by the railway time convention in St. Louis, the time of the different long railways of the country would only differ by whole hours. It is proposed that each road shall reckon its time from one or more of a set of meridians fifteen degrees, or one hour, apart, so that the time of each meridian may reach seven and one-half degrees, or thirty minutes, on each side. The meridians suggested for the United States are the 75th, 90th, 105th, and 120th, west of Greenwich. The confusion of time now so common in many of our large cities would in this way be avoided, the minutes and seconds, at least, agreeing on the different roads.

— The treasurer of the Balfour fund acknowledges the following additional subscriptions: Prof. J. Playfair McMurrich, Ontario, \$5; T. Mackenzie, University college, Toronto, \$1; George Acheson, Collegiate institute, Toronto, \$2; H. Pillsbury, High school, Springfield, Mass., \$1; Prof. J. H. Comstock, Cornell university, \$5; Prof. J. A. Holmes, University of North Carolina, \$5; Prof. H. C. Coon, Alford university, \$1. Previously acknowledged, \$466.25.

— In SCIENCE, p. 338, in the article on Formation of the tails of comets, read, 'Mr. Ranyard suggests.'